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Electrical Review

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Index to Advertisers—Page xl.

Principal Contents:

	PAGE
Is "Automatic" Cooking Needed?	187
Trailing Cables and Plug Connectors. By H. Taylor	190
Teaching Electrical Engineering	191
"More Plug Points." By "Salesman"	192
Repulsion Induction Motors. By C. V. Hill	193
Breakdowns Caused by Vermin. By E. Ingham	194
Automatic Cooker Control	195
Electricity in Agriculture	197
Meetings and Discussions	199
Correspondence: Private Plants for Garages; Distribution Efficiency; Two-part Tariffs; Electricity in a New House	201
Generating Plant in a London Store	202
New Apparatus and Devices	203
Domestic Electrical Appliance Production	205
New Books	206
United States Electrical Exports	207
Business and Industrial Notes	208
Electricity Supply	212
Traction and Communications	214
Contract Information	215
Notes	216
Our Personal Column	217
Financial Section	218
Published Specifications	221
New Work for Contractors	222

Is "Automatic" Cooking Needed?

TO-DAY we publish a review of many very conflicting ideas gathered during a lengthy investigation into the merits and demerits of automatic cooker control. They range from wholesale condemnation of the idea to a call for the extension of automatic control from the oven to the boiling plate.

We regard such diversity of opinion at this stage as inevitable, and free discussion is all to the good. Sooner or later the electrical industry may have to make a decision favourable or otherwise towards the general adoption of automatic cooker control, but we very much doubt whether the decision, whatever it may be, can be brought about through the usual method of catering for individual demands as and when they occur. The issue is much too involved for that, and the interests of the supply and manufacturing sections are bound up together as never before.

Electric cooking is definitely established and it is one of our greatest hopes for the load-building programme for the next few years. But that position has not been brought about by normal commercial dealing. It embraces the sale of electricity to the consumer on ordinary business lines, and hiring-out schemes for the equipment which are still severely criticised.

Some supply authorities are naturally apprehensive regarding the possible effect of the new development upon existing schemes which are designed to pay for themselves over a period of years.

The automatic-control propaganda of the gas industry has undoubtedly captured popular attention to a very large extent, and the advances already made in electrical automatic cooker control indicate that many in the electrical industry consider that the gas industry has issued a challenge which should be accepted.

We would be the last to suggest that the electrical industry must adopt a measure simply because the gas industry has done so with success, but to give the *correct* answer to such an appeal is of vital importance.

If the gas move is just an attempt to reach a level which the electrical industry achieved some years ago, then the answer is already in the hands of our salesmen. If, on the other hand, automatic control can advance the cause of electric cooking on purely practical merits, then the electrical engineer, indeed any class of engineer, knows by long experience that there is no other service more favourable to the application of automatic control, particularly temperature control, than the electrical service.

But the electrical man must tread carefully along this extremely thorny path. The industry is still suffering from the attempt to instil the thermal efficiency idea into the mind of the consumer, and we strongly suggest that we avoid talking of the heat-treatment of food.

It must be remembered that a good appliance can do worse than defeat its own object in the hands of the uninitiated. In saying this we have in mind certain experiences of the space-heating engineer in finding the thermostat used as an accelerator rather than as a governor, and our review shows that in some cases, at least, gas automatic control has been discarded by consumers after trial.

This leads us back to our starting point—is "automatic" cooking needed?

Support the Fair

ROYALTY has been so closely identified with, and so keenly interested in, the British Industries Fair ever since it was initiated in London in the early days of the War, that it will not be desired either by King Edward or by Queen Mary that in 1936 it shall be affected adversely by the atmosphere of national mourning. Though the Mansion House banquet, always a brilliant affair giving the event a good send-off, has been abandoned, all other functions, we believe, will take place as usual. As before, the Advisory Committee of the Electrical Section has made luncheon and speech arrangements for a number of electrical days at Birmingham. The two Tuesdays (Feb. 18th and 25th) should be the more important if representatives of numerous electrical institutions and associations announced to take part are present, and on

other days the E.A.W., the E.P.E.A., the Association of Mining Electrical Engineers, and Students of the I.E.E. will, we hope, hold useful gatherings. The Committee has secured some well-known speakers for one or other of the days; they include Lady Swaythling, Lord Hirst, Mr. J. C. Dalton, of the County of London Co., and Mr. J. W. Beauchamp, commercial manager to the Central Board, and we hope that those for whom these events are organised will back up the committee by attending to hear what these speakers have to say. There are so many buyers of electrical products in these days, and trade exhibitions are very rare; in fact the British Industries Fair is the only annual opportunity for the whole industry. Let all who can possibly do so make a special point of contributing to the success of the Castle Bromwich and Olympia shows, which open on Monday week!

Temporary Installations

WHILE the standard of electrical work in stores, and many smaller shops also is regarded by the L.C.C. inspectors as having steadily improved in recent years, the temporary lighting installed during the past Christmas season on other commercial premises —more particularly in the methods employed for connecting them to the permanent wiring—was found to have too often betrayed an absence of real knowledge of wiremanship. Any satisfaction on account of better installation work is somewhat tempered by criticism of the electrical arrangements in force where children's entertainments were provided; these are said to have been "without exception" below the standard required for bazaars and small exhibitions at premises licensed by the Council for music and dancing. In general, the chief risks from temporary work were in connection with wiring either festooned with, or running adjacent to, flimsy decorations, but the more common use of a few substantially installed floodlights, instead of a large number of small lamps placed among the goods, has no doubt reduced fire risks materially. If the I.E.E. Regulations requiring that *competent* persons should take full responsibility for temporary installations had been observed everywhere, the risks complained of should not have been incurred.

The Electrical Programme

THE year is sufficiently far advanced for our readers to be thinking forward regarding the special electrical functions of the summer months. In the late spring some of us will have reason to notice the collapse of our February programme of social activities as deferred events clamour for attention. Soon after the Fair closes its doors the Ideal Home at Olympia will be upon us, and the I.M.E.A. Convention will follow in Edinburgh in June. Whatever places the I.E.E. summer meeting, the E.C.A. conference, or the Mining Electrical Engineers' celebrations may occupy in our plans this year, we have to include in our calendar what would be a novelty to electrical men—were it not for reminiscence concerning those exciting little cruises of the early Batti-Wallah days—namely, a cruise organised in the interests of the funds of the Electrical Industries Benevolent Associations. It is hoped that a considerable company will enjoy the holiday cruise in the liner *Vandyck*, which commences on August 22nd. Those electrical men and women who like to spend their holidays together will have the added satisfaction that they are assisting a very worthy object. Some particulars of the arrangements were given in the REVIEW of January 24th (page 142), and a photograph of the vessel appears on p. 201.

Another Change-over Problem

IN the ordinary way it does not matter a great deal if an appliance rated at 1,000 or 2,000 W is actually loaded at 50 W less or more, but when a system is changed over from d.c. to a.c. trouble may occur with the consumer concerned. Speaking at an E.P.E.A. meeting last week, Mr. F. W. Purse said that he had encountered cases where bills had been appreciably increased because over-rated elements had been replaced by correctly rated ones. This naturally annoyed the consumer, who immediately concluded that a change-over was merely a scheme for getting more money out of him. On top of this, improved voltage regulation led to greater consumption by lamps. These, and the greater accuracy of a.c. meters on light load, are among the little matters which keep some consumers' engineers awake at night.

Glass Water Heaters

GLASS instead of tinned copper for domestic electric water heaters and pipe work is being used experimentally in Germany, according to the *Zeitschrift des Vereines Deutscher Ingenieure*. Cylindrical storage tanks up to 22 gal. capacity have been constructed with hemispherical ends and a wide neck, to which is bolted a flange carrying an immersion heater and thermostat. The tanks are mounted in plywood boxes from which they are heat-insulated by corrugated paper and aluminium foil. The glass is said to be free from cracking within the usual temperature range and to withstand rough usage. Existing unions are retained by fitting a rubber sleeve between the glass piping and a short piece of copper pipe in the union, the flexibility ensuring register between the pipe and the tank outlet. Moulded composition unions are also under trial as a convenient alternative. Joints between lengths of glass piping are made by metal sleeves with tin seals. Experience to date is that the method has economic advantages; but it would appear to have a hygienic value also.

Oil From Coal

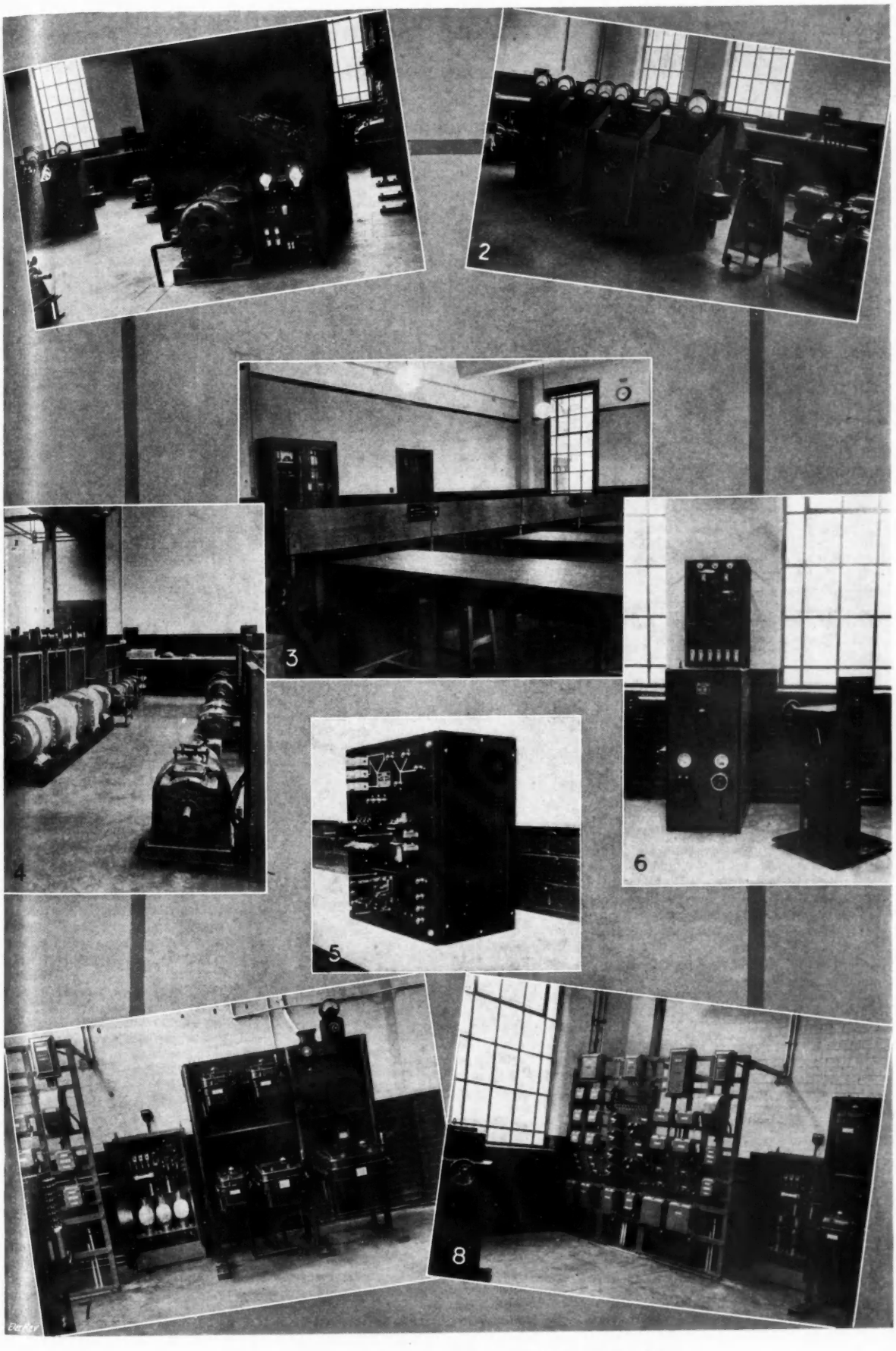
A REPORT by the Department of Scientific and Industrial Research provides the first official information available on the experiments for converting coal into oil that were begun in 1923 at the Greenwich Fuel Research Station. These were extended in 1927 and culminated recently in the Billingham plant of Imperial Chemical Industries. Fuel Research Technical Paper No. 42 (Stationery Office, 1s. 3d.) states that the Bergius system, which works at a pressure of 15 atm. and at temperatures of 340 deg. C. and upwards, gives a 70 per cent conversion into oil soluble in benzene. The results of the preliminary operations should stimulate the development of high-speed heavy-oil engines of the large capacity required for generating stations. They should also lead to renewed investigations into the conditions under which oil firing, despite its higher cost, can be advantageously employed in capital generating stations, possibly in combination with pulverised fuel, for large boilers.

BRITISH INDUSTRIES FAIR

This annual exhibition of British products opens at Birmingham and London on February 17th, and the next issue of

THE ELECTRICAL REVIEW

will contain an illustrated guide to the electrical and allied exhibits in both sections. This should prove useful both to prospective visitors and to those who cannot attend.



The Coventry Technical College. **(See page 191)**

1. Motor-generator set (25 kW) with automatic and manual regulation. 2. Desk-type machine control panels and portable loading unit on right. 3. Cable trough and circuit-breakers for island bench experiments. 4. A double line of experimental machines. 5. Experimental thyratron equipment. 6. Moving-coil voltage regulator to grid-controlled mercury-arc rectifier with battery-charging panel. 7. Main incoming and outgoing board and (left) hot-cathode rectifier. 8. General distribution board for the Electrical Department

Trailing Cables and Plug Connectors. By H. Taylor

A commentary on the various types and their comparative suitability

FROM time to time the Electrical Inspector of Mines has called attention to the number of accidents associated with the use of trailing cables and "free-plug" connectors, which are considered as constituting the most dangerous part of the electrical installation. As a measure of additional safety he has suggested the use of pliable-armoured cable with standardised detachable cable-dividing boxes, and has published diagrams illustrating their application. The objects aimed at are (1) limitation of the length of unarmoured trailing-cable; (2) provision, by the use of a length of pliable-armoured cable, of means to enable the gate-end switch to be moved forward as often as necessary; and (3) elimination of temporary jointing below ground.

It is intended that standardised detachable cable-dividing boxes should be attached to the cables before they are taken into the mine. They may have projecting terminals for bolting to corresponding terminals in the terminal-box of the switch, or they may be used in combination to form a bolted plug-and-socket coupling. Among other advantages there will be a substantial saving of electrician's time, because of greater reliability and convenience, and a reduction in the risk of accident. Rapid transportation of distribution and gate-end switchgear to follow the advance or retreat of the coal-face is greatly simplified by the use of detachable cable-end boxes, which allow cables to be uncoupled from apparatus without unsealing the cable-ends.

Kinds of Cable

There have been many variations in design and types of trailing cables, but two types only will be considered here, namely, unarmoured flexibles and pliable-armoured cable. Ordinary trailing cables for use with coal-face electrical apparatus have undergone many changes since they were first introduced, but the majority of those now in use comprise a number of fine wires in each core to give the necessary flexibility, covered with a layer of very tough vulcanised indiarubber. Various external braidings of whipcord, leather and the like have also been designed and marketed. For some protective systems a layer of woven wires was introduced into the cable, surrounding the insulated cores and embedded in the rubber sheathing; such cable was generally described as "ferflex," and sometimes as "ferflex braided." A pliable-armoured cable is a trailing cable with a layer of armouring wires surrounding the insulated cores, each strand of the armouring comprising seven wires of small gauge laid up in a standard way with a lay calculated to give maximum flexibility.

In his latest report the inspector protests against the unnecessary use of unarmoured flexible cables and "free plugs" for the supply to conveyors, loaders, small haulers, inbye pumps and similar temporarily fixed apparatus, and states that "pliable-armoured cable and bolted plug couplings, sometimes called "flit plugs," will meet practical needs.

A free plug is a plug that can be withdrawn from its socket either by unscrewing a retaining ring or by manipulation of a retaining bolt without the use of a special tool to detach one part from the other. A flit plug is a cable coupling of the plug-and-socket type, the two halves of which are fixed together by screws or bolts inserted in flanges and so arranged that they cannot be taken apart without the use of tools. The original designation "detachable cable-dividing box with plug connections" was found to be rather cumbersome. In Scotland the word "flit" is used as meaning "to change one's abode," and in mining it is usual to refer to "flitting" the coal cutter when moving it to another position; hence the short name "flit-plug" was introduced to describe a bolted plug-and-socket coupling that could be readily detached for removal.

Electrical Interlocking

Many engineers will agree that the general adoption of electrical interlocking for free plugs and the use of screened cable (referred to in the 1934 report) would considerably reduce the number of accidents associated with the use of trailing cables and plug connectors. Where a free plug is used, to comply with the Mines Act a separate earth core must be provided in the trailing cable, but electrical interlocking, although not compulsory, is strongly recommended. It involves, however, an additional pilot core in the trailing cable and additional equipment in the controlling switchgear. As an inherent feature of the control, electrical interlocking is now extensively used for coal-cutters which require a free plug and come under the heading of "portable apparatus." Coupled lengths of trailing cable are generally unnecessary, but where trailing-cables are extended by the use of loose plugs it is essential that electrical interlocking shall be incorporated as a means of protection in the gate-end switch.

For smaller machinery such as conveyors, loaders, and inbye pumps, which have to be moved frequently, free plugs are in common use, generally without the precaution of electrical interlocking, and such machinery, when so used, has to be considered as "portable apparatus."

The report suggests, however, that a flit plug with pliable-armoured cable may be used instead of the free plug for such machinery. Further, when a flit plug is used, it is permissible to dispense with the earth-core and to use the pliable-armour screen as the earth return. When used under these conditions the machinery comes into the "semi-portable" category.

The difference between portable and semi-portable or fixed apparatus, so far as the Coal Mines Electricity Regulations are concerned, appears to need emphasising. It has been asked how the use of a flit plug on a pliable-armoured cable converts a conveyor from portable apparatus to fixed apparatus. Actually, of course, it does not do so as far as the physical operation of moving the conveyor is concerned, but electrically the difference is quite clear. If a free plug is used to couple up a conveyor, it is essential to have an earthing core in the cable, preferably interlocked electrically with the gate-end switch; but it is not permissible to use the metallic covering or screening of the cable as the earthing conductor for the apparatus, since it is not permanently attached.

If the metallic covering or pliable armouring is used as the earthing conductor it must be permanently attached to the apparatus, which then, for the purpose of the Regulations, becomes semi-portable or fixed. When a flit plug is used the metallic covering becomes permanently attached to the apparatus, because a flit plug requires tools for its removal.

Desirability of Skilled Attention

The use of flit plugs necessitates the attention of a skilled electrician for coupling and uncoupling the apparatus, and this may not always be convenient; but such skilled attention is obviously much safer than any arrangement under which an unskilled person may be in a position to remove a free plug when it is alive. The use of pliable armour for screening the cable may also be reasonably expected to reduce the risk of damage to the cable itself with its possibility of consequent accidents. Further, since the person responsible for coupling the cable to the apparatus will probably also be responsible for cable repairs, precautions will naturally be taken to ensure that the cable is so run as to minimise the risk of damage.

It is difficult to make a comparison of working costs, but the additional cost of the attendance of a skilled man during the removal of the apparatus may be assumed to be easily balanced by the saving of repairs of cables and apparatus that would probably become necessary if the work were left to unskilled men.

Under the arduous conditions met with below ground the very rough treatment and inattention that free plugs receive from unskilled persons, such as leaving the free end loose on the ground or even in a pool of water, necessitate frequent overhauling and replacements. There is also the possibility of danger with a free plug from the pulling out of the cable tails, which is absent with the flit plug as the cable tails are run-in solid and the armouring is anchored.

Moisture is another cause of trouble with free plugs that can be greatly diminished by the use of flit plugs. It may be argued that it is not essential to have a flit plug where the pliable armour of the cable is used as the earth return, and that the conditions can be met by a detachable cable-dividing box having facilities for connecting the cable tails to the apparatus in a separate flameproof terminal-chamber; but this method is clearly not so convenient.

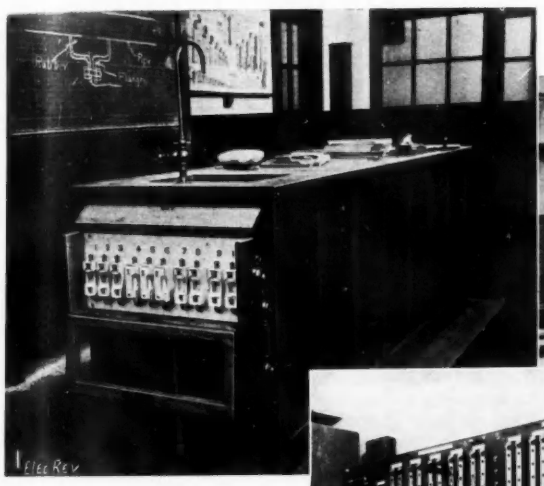
The majority of colliery electrical systems are now three-phase, with the neutral point earthed, and the provision of earth-leakage protection on the core-balance principle is in general use. With this system of protection and the use of screened cable the danger of open sparking due to trailing cable faults is reduced to a minimum, since any damage to the cable must cause or quickly develop into an earth fault, which disconnects the supply instantly. Earth-leakage protective equipment operating instantaneously with fault currents of not more than five per cent. of the normal current, with stability under normal conditions, is now widely used. With a non-screened cable heavy open sparking may occur, although no earth fault develops; under these conditions over-current protection is relied upon to disconnect the supply. Since the over-current protective apparatus may have been set to operate with delayed time action at very heavy overloads to enable it to deal with starting surges, the reason for official preference for earth-leakage protection and screened trailing cables is obvious.

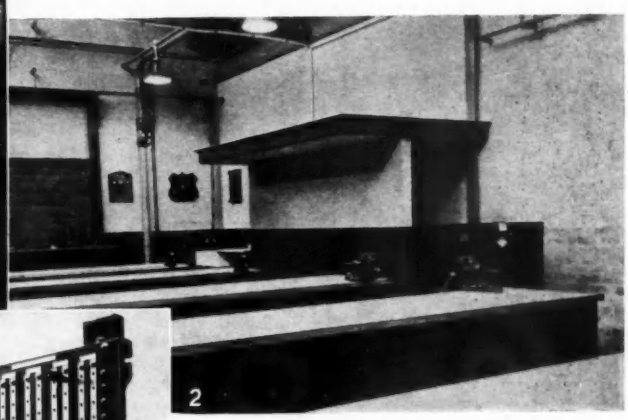
Teaching Electrical Engineering

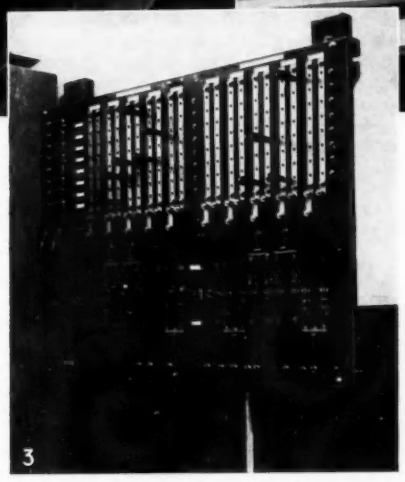
The lay-out of equipment and accommodation at the new Coventry Technical College

CATERING for the varied requirements of about 850 students is the present task of Mr. A. C. R. Ritchie, Head of the Electrical Engineering and Physics Department of the recently inaugurated Municipal Technical College at Coventry. About 125 students are pursuing part-time day courses in electrical engineering, up to Higher National Certificate standard, while 220 evening students are working on electrical engineering, electrical installation, telephony and telegraphy, radio communications and electro-technology for mechanical engineers. Further, 250 students take physics subjects in the department, while 250 junior technical school boys take physics as part of their normal course.

A notable feature of the scheme as a whole is the close co-operation which exists between local manufacturers and the college, as the result of which nearly all the important firms in the town allow selected apprentices time off to attend the college. Another commendable arrangement is that whereby a certificate is awarded to a student at the end of his apprenticeship on the joint report of the College and the works.







1. A demonstration bench at the Coventry Technical College, showing the selective terminal board for varied supplies. 2. The electrical installation workshop; the standard house wall and ceiling for wiring assembly practice can be seen. 3. The plug-in distribution board for varied supplies in the advanced students' laboratories

Most of the students in electrical engineering attending the College are engaged during part of their time at the Coventry works of the General Electric Co., Ltd., and the British Thomson-Houston Co., Ltd.

There are two classrooms fitted with special benches to permit drawing-office work, each room accommodating about thirty students. Two lecture theatres with rising floors in six-inch steps have seating capacities for fifty-two and seventy-two students respectively, while there are also twenty-student and thirty-student elementary laboratories, light-current and advanced electrical laboratories, a photometer room, an electrical installation workshop and a separate instrument room, for precision work, and a well-equipped machine laboratory. Between the two lecture theatres and communicating with them is a preparation room, and this scheme is repeated for the two elementary laboratories and also for the light-current and advanced electrical laboratories.

An unusual feature of the photometer-room equipment is the large integrating cube (1 yd. cube), while further apparatus in this room includes a standard two-metre bench outfit. In the installation workshop we were impressed by a simple structure which offers a brick wall and a typical household ceiling and floor for the actual fixing of wiring. When these are worn out it will be a simple matter to remove the structure and build a new one. Swinging frames on the main wall will afford excellent means for assembly work.

The scheme adopted in the light-current and advanced electrical laboratories will, we believe, go a long way towards solving the difficulties usually encountered in providing economically for efficient cabling schemes for experiments demanding many types of supply and varying pressures. In each of these rooms a cable trough is placed at the working level between the two rows of benches, four miniature circuit-breakers (with six-way terminal bars) being fixed at convenient points, two on each side of the trough. Thus any circuit-breaker can be connected to a bench with a minimum of straggling leads and each bench connection will work independently of the others, affording security to the whole. On the wall benches there are two similar circuit-breaker units and the whole of these equipments contribute to a unique variable-supply scheme which is fed from a distribution board.

Each of the two main sections of this board, which is installed in the preparation room, serves one of the rooms, and for each section on the front of the "Sindanyo" panel there are five vertical bars which can be connected to any of the eight horizontal supply bars at the back of the panel by screw-in connectors. The horizontal bars are connected to suitable points of the battery, so that the many combinations of connections thus afforded will permit practically any voltage between 2 V and 60 V to be obtained.

Extension links at the bottom of the vertical bars are intended for the application of counter e.m.f. cells. The vertical bars connect one side of change-over switches which feed from their mid-points the miniature circuit-breakers in the laboratories, but the usefulness of the scheme is extended beyond the battery limits by connections from the other side of the change-over switches to the electrical machine laboratory equipment, by which any voltage up to 400 a.c. or d.c. can be made available in the rooms.

Another excellent distribution scheme permits the provision of any available type of supply or pressure at the demonstration benches in any of the laboratories, lecture theatres and class-rooms. At the end of each demonstration bench is fixed a ten-line terminal board with isolating fuses. The terminals are numbered 1 to 10, and they connect with correspondingly numbered terminals on a distribution board in the machine laboratory. Telephone communication between the machine laboratory and the room where the supply is required affords the necessary supply at selected terminals at the bench at short notice.

Most of the individual elementary laboratory experiments are carried out with portable "Exide" accumulators, for the charging of which there is a suitable Westinghouse metal rectifier. For such experiments and for demonstration work there is a very comprehensive range of modern instruments, including a complete cathode-ray oscillograph equipment.

The Electrical Machine Laboratory

The isolating of all the machine laboratories and practical workshops in one block separate from the main college building is believed to be a unique scheme for this country and certainly not the least important room in this block is the electrical machine laboratory. In this room is arranged the equipment for the incoming and outcoming supplies for the whole of the electrical department. From the college substation a 400-V, three-phase supply is received by a 300-A

Ellison industrial-type oil circuit-breaker assembled on a board with similar but smaller components which supply individually a 30-kVA 400-V to 200-V, three-phase transformer, a 25-kW motor generator unit, a 20-A, 230-V grid-controlled mercury-arc rectifier and a 20-kW hot-cathode rectifier for 230 V a.c. supply.

These equipments and other machines which can be supplied by them at will, and also a battery, afford a variety of supplies to the distribution board in this room to which the ten lines for the variable supplies at the demonstration benches are connected. Indeed, this board serves the whole electrical department and also affords a d.c. supply to the mechanical engineering department. All these sources of supply are connected to switch-fuses at the bottom of the board and these, in turn, communicate with terminals on a central " Sindanyo " panel. Similar terminals on other panels connect with switch-fuses which afford supplies for experimental purposes at various points, so that by temporary cross-connections between the two groups of terminals any experimental point can be connected to any supply source. Change-over switches give alternative supplies to the mechanical engineering department from either the motor-generator set or the hot-cathode rectifier. One feature of the whole of the equipment throughout the electrical department is economy in cost (the distribution, board supplied by the Artic Fuse and Electrical Manufacturing Co., Ltd., cost £65). For operating in conjunction with the 400/200-V transformer for experimental work there is a Ferranti moving-coil regulator which can be isolated from the supply for experimental purposes and which, by buck or boost, offers a voltage range from zero to 400 V with infinite variation. We should say that the comprehensive and well set out data on an engraved plate on this equipment would alone afford more than sufficient material for one lesson.

Automatic Voltage Regulation

The 25-kW motor-generator is of Crompton Parkinson manufacture and is operated in conjunction with thyratron equipment for automatic voltage regulation. This automatic gear and equipment for manual regulation are housed in a common desk-type control unit, and we were interested in a comparison of the two control systems with similar loading conditions. The suspicion of a needle movement with direct 90-A on- and off-switching, as against variations from 230 V to 170 V with manual control under similar conditions, was certainly convincing. The actual guaranteed figures of the thyratron equipment are one per cent. regulation within ¼ second of the application of full load. It operates through a six-minute time-delay relay.

The motor of the set, by the way, is started up by direct switching and, as we saw it, the instrument " kick " did not suggest serious line interference. The 20-kW B.T.H. hot-cathode rectifier also has a synchronous motor time-delay relay, and we consider that its outstanding feature is its compactness as it is all housed within about 4 ft. by 3 ft. by 18 in. It is fed at 400 V, three-phase and supplies at 230 V, d.c.

The E.C.C. grid-controlled mercury-arc rectifier is supplied at 400 V three-phase and, in addition to operating at 200 V three-phase for experimental purposes, it is also used for battery charging *via* an Igranic panel by which it is surmounted. A 250-V 40-Ah enclosed-cell " Chloride " battery forms the fourth source of d.c. supply for experimental purposes, but it is also used for emergency lighting at selected points in the college, when it operates in conjunction with a " Keepalite " contactor panel.

It was because of the advisability of adopting 230 V for the emergency lighting that that pressure was decided on for the main supplies of d.c. for experimental work. When considering the working three-phase voltage 230 V was ruled out because that pressure suggests single-phase supply.

Experimental Machines

A few of the many interesting experimental machines are a four-unit tandem set with two 5-h.p. shunt motors and two 3-kVA three-phase alternators, with facilities for brake testing; a three-unit C.P. set with one of its two 3-h.p. compound d.c. machines trunnion-mounted for dynamometer testing and a 3-h.p. slip-ring induction motor; a pair of 3-kW rotary convertors directly connected through a graduated coupling, each machine having six slip-rings, thermo-couples in the field windings and a " Joubert " disc for exploring the flux distribution; a three-phase induction motor two-phase alternator set and a 1-h.p. Higgs series motor for use with a special experimental three-phase thyratron rectifier with an output of 7.5 A at 230 V which will permit experiments with almost any of the thyratron circuits.

Quite an advance in instructional laboratory work is represented by the machine control panels. They are of the desk type, housing the starters and field regulators, and all the machine and equipment terminals are brought out to the panel, on which the windings are also represented. The important point is that the student has, in effect, to manipulate the machine terminals. Another good point about these desks is the instrument mounting. Crompton Parkinson have supplied the instruments with single mounting pegs which are received by suitable sockets in the top of the desk frame. By means of inter-connecting mains here and there any of the machines can be connected to any of the wall terminals, to one another, to the loading board, or to any of the laboratories or lecture rooms. Loading facilities are provided by portable resistances made by Messrs. Isenthal & Co., Ltd. With its electric-fire elements, each loading set will absorb eight kV in ten steps with four-switch control. The set runs on wheels and the terminals and switches are mounted on a suitable panel.

In the lay-out and equipment of the department much helpful advice has been given by Mr. H. E. Dance, H.M.I.

"More Plug Points." By "Salesman"

MORE electricity must be sold, and there is little doubt that the person to whom it must be sold is the ordinary everyday householder. In the industrial field electricity holds practically undisputed sway, and where it does not, the reason why, is usually so good that a salesman's efforts are probably better devoted elsewhere.

There is not the slightest doubt but that the most important attribute of the electric power company, be it private or municipal, is the art of salesmanship, which in other words, means gaining the consumer's and would-be consumer's confidence. Nobody is better aware of this fact, than a person connected with the electrical industry, and who in private life mixes socially with a considerable number of electrical consumers. As a friend or acquaintance such people approach him on electrical matters, and it is indeed surprising what inconvenience even well-to-do people will put up with due to the shortcoming of their electrical installations, and staggering when one contemplates the amount of revenue that must be lost to the supply authorities.

As an instance of this I may quote the following: I gave a number of domestic electrical aids as Christmas presents, one of them being a modern chromium-plated table lamp which was sold with the usual bakelite lampholder adaptor. Naturally I undertook to fit it up. Each room was provided with a 15-A two-pin socket, in addition to the usual and only centre pendant, there being in use a 2-kW portable fire, a large all-mains radio set, and the domestic iron, each accessory being fitted with a 15-A plug. It is easy to see from the above combination that there arose many occasions in the year when it would be desired to run the radio and the fire together, yet the existence of such a fitting as a two-way 15-A socket adaptor had never been brought to the attention of the householder.

I supplied him with a two-way 15-A socket adaptor, arranged to take two 15-A plugs on the sides and a 5-A plug on the top; and exchanged the lampholder adaptor on the table lamp for a 5-A plug fitted with two 2-A fuses in its head, thus enabling this particular householder to make full use of his electrical equipment. Since the above incident, I have been asked by the householder's neighbours, through my friend, to supply no fewer than seven such fittings.

Another example was a ladies' hairdressing establishment. The proprietress ran four cubicles in normal times and erected a fifth in rush seasons; she had two hood type hair-dryers, each rated at 1 kW, but only one convenient 15-A 3-pin socket between the fourth and fifth cubicle. As the fifth cubicle was a temporary fitting, she had been content for a long time past to run a small hand dryer off a 5-A circuit when all the cubicles were full. The fitting-up or rather supplying of a 15-A 3-pin two-way adaptor changed this, and incidentally increased the load during the rush season by at least ½ kW.

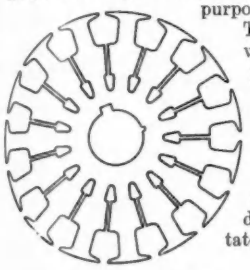
Electrical purists might argue that such arrangements as these are not good practice, but some method of increasing the number of socket outlets must be used if the electrical domestic load is to go on increasing satisfactorily, and how many houses have more than one plug per room? As one plug point per room seems to be the standard arrangement, why cannot the power companies issue a small booklet to likely consumers showing safe combinations of socket and plug outlet adaptors, with the slogan, " Get more from your plug point." Surely the prospective increase in load will make this worth while.

Repulsion Induction Motors.

By C. V. Hill, B.Eng.

The requirements for general service on single-phase systems

THE increasing use of motors on single-phase mains has led to the development of many types of industrial machines differing widely in their starting and running characteristics. In any particular type, however, desirable features are usually accompanied by others less desirable. Thus, for example, the simplest and cheapest, the squirrel-cage induction motor, is handicapped by its poor starting performance, and relatively high running current. It is therefore of importance to a frequent user of single-phase motors or to a manufacturer who will re-sell such machines with his own products, to choose the best all-round general-purpose motor.



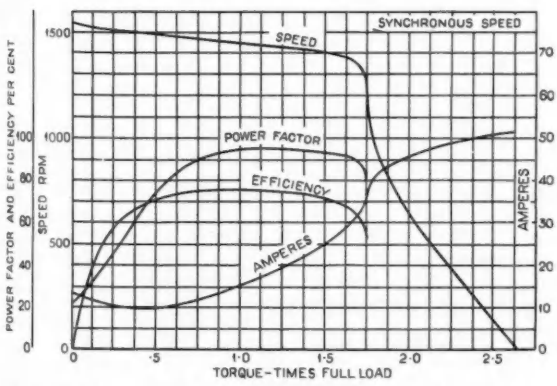
Typical rotor punching for a B.T.H. "CKS" motor

The repulsion-induction motor, which has strong claims to this position within the range of industrial motors, combines the two principles implied in its name both at starting and when running (as distinct from the earlier repulsion-start induction motor), having a centrifugal device to short-circuit the commutator during acceleration, so converting the repulsion-start motor into a single-phase induction motor.

As single-phase mains are usually employed where the principal load will be lighting, more stringent starting-current regulations are imposed by the supply authorities upon motor users than where polyphase supplies are given. The load on single-phase systems is naturally chiefly of a domestic or semi-domestic nature, the greatest demand being for fractional h.p. sizes. In the industrial range the demand for machines above 10 h.p. is relatively small.

Although certain drives, such as small fans, and centrifugal pumps provide inherently easy starting conditions there are many cases such as laundry and baking machinery drives where the motor must start against considerable load. In other instances the starting regulations imply a high starting torque per ampere so that when the current-limiting device is in operation there is still sufficient starting and accelerating torque available to ensure an easy run up to speed. Even where fast and loose pulleys or their equivalent can be used a starting performance of a high order is called for.

The simpler forms of single-phase motors are not self-starting; only commutator motors, such as the series or repulsion



Characteristic curves of a single-phase, four-pole repulsion-induction motor (3 h.p., 1,450 r.p.m., 210 V, 50 cycles)

types, can develop starting torques without the use of some auxiliary device. Thus the induction and capacitor motors make use of a "phase-splitting" device which, for industrial sizes, is contained partly in the motor and partly in the motor starter. The latter also houses the current-limiting device, if required, and carries out the necessary switching operations to change over from starting to running connections. The starting gear for such machines becomes expensive compared with the motor, and the two are associated so closely that they must be designed and sold as a single unit. Starting conditions should be known at the time the motor and starter are built, since phase splitting is most effective at the load for which it is designed. Manufacturing requirements necessitate, however, that as many parts as possible are stocked, and a compromise is usually effected by assuming standardised performance figures and varying them where necessary by a current limiting device or suitable switching associated with the windings.

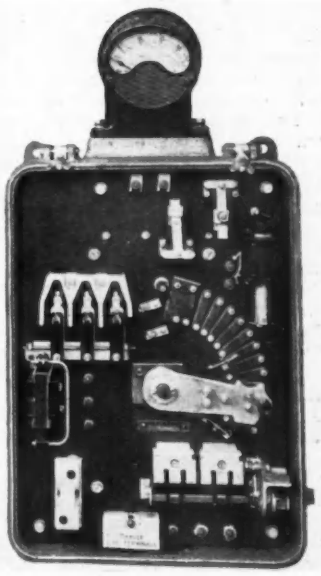
The necessity for this is a disadvantage in a general-purpose motor. It is desirable to be able to buy a machine for stock before its final situation has been determined, knowing that in the event of current limitations being imposed they will involve only the addition of a comparatively simple current-limiting device and not a possible change in the equipment originally purchased.

Although a repulsion motor has an inherently excellent starting performance, it has also "series" speed characteristics, the speed varying with the load. The repulsion motor

A 3-h.p., 970-r.p.m., screen-protected motor (Type "CKS 4120")

therefore has only a limited number of applications, but some time ago there became very popular a motor which was arranged as a repulsion motor at starting only, and was converted to an ordinary single-phase induction motor by a centrifugal switch when up to speed. Centrifugal mechanism can, by good design, be made practically trouble free, but its absence would eliminate a possible source of trouble and simplify considerably the construction of the motor. To minimise brushwear a further mechanism was introduced for lifting the brushes at the instant that the commutator was short-circuited. Power factor and efficiency showed no improvement over those of the split-phase induction motor.

The principle of changing over from repulsion to induction motor involves the matching of two torque curves, in the first of which the torque decreases in value with the speed, whilst in the second it increases. In order to avoid an excessive dip in the resultant torque curve the starting torque and current have to be made considerably greater than would otherwise have been necessary.



A panel with face-plate starter, circuit-breaker, line switch, &c.

In order to improve on this arrangement the repulsion-induction motor was developed. This dispenses with centrifugal mechanisms and combines the action of both repulsion motor and induction motor through the medium of a special form of rotor. The punching includes two sets of slots joined by narrow radial slits. The outer slots carry the commutator winding, which is similar to a d.c. armature winding, and the inner slots carry a squirrel-cage winding.

At starting and during the acceleration period the magnetic

flux produced by the stator winding embraces only the commutator winding due to the high reactance of the squirrel-cage; that is, practically the whole of the flux crosses the slits. Under these conditions the motor is virtually a plain repulsion motor and as such gives a large torque per ampere. As the motor approaches full speed the magnetic flux assumes the form of a uniform magnetic field rotating at synchronous speed, and the slip frequency of the squirrel-cage in this field decreases. The reactance of the squirrel-cage thus decreases and an increasing proportion of the flux links with this winding, until at full speed practically the whole of the flux links with it. An induction-motor torque is thereby superimposed upon that of the commutator winding.

By careful design the resultant torque-speed curve can be made smooth and free from dip when approaching full speed. This is secured without making the starting torque unnecessarily high compared with the pull-out torque, as with the repulsion-start induction motor; thus the starting current per h.p. can be made lower. On light loads, when synchronous speed is exceeded, the squirrel-cage exerts a braking torque which prevents the speed increasing to more than two or three per cent. above synchronous speed. The combined action of the two rotor windings produces a higher power factor on load than would be obtained with either winding acting alone.

Efficiency is not adversely affected by losses from continuously operating the commutator and brush-gear, since the load is shared by both windings. Without slits between the upper and lower rotor slots a good starting torque per ampere accompanied by high efficiency and power factor when on load cannot be obtained. There is also a possibility of over-speed running on no load. Since the high power factor and efficiency result in a low running current per h.p., due allowance should be made when expressing the starting current in terms of full-load current in comparison with motors having a higher full-load current per h.p.

The commutation of the repulsion-induction motor is superior to that of the repulsion-start motor during acceleration and is practically sparkless on load. This is mainly due to the squirrel-cage winding and to strips of special material occupying the slits between upper and lower rotor slots, which absorb the energy that would otherwise appear as sparking at the brushes. In addition, good commutating conditions automatically result from the motor operating near synchronous speed.

The repulsion-induction motor can be employed where quiet operation is essential, as for organ blowing, but in such cases further attention must be paid to details such as the use of sleeve bearings, and also the rating for a given frame size must be reduced. The repulsion-induction motor is not so quiet at starting as when running on load, and so for duties where quiet starting is essential, *e.g.*, certain lift drives, it may be preferable to use a capacitor motor.

Perhaps one of the strongest claims of the repulsion-induction motor is the simplicity and flexibility of its control gear, and the ease with which the combination can be adapted to supply authorities' regulations. Where the latter permit, the motor may be switched directly on the mains with the minimum of control gear, such as a circuit-breaker or switch fuse, and will give a starting torque of two and a quarter to three times full load torque with a starting current of 3¼ to 3¾ times full load current; it is thus suitable for the most severe starting duties. Where starting-current limitations are imposed, or where the above torque would be excessive for the duty, the torque and current can easily be reduced to any desired extent by the use of a suitably designed rheostatic starter, the torque varying as the square of the current for any reduction so obtained.

This may also be combined with a contactor-type line switch and circuit-breaker on a single panel. In these simple starters sufficient steps to secure small current increments per step can be economically included, thus enabling stringent supply regulations to be met. Another method of starting is by a series-parallel switch, the motor stator winding being arranged for this purpose. The starting torque will then be approximately half full load torque with 80 per cent. full-load current.

When comparing the relative costs of single-phase machines, motor and control gear should be considered together as a single equipment. Owing to the simplicity of its control gear, the repulsion-induction motor equipment tends to become relatively cheaper for the smaller horsepowers most frequently required, *i.e.*, from ½ to 10 h.p., although machines have been successfully applied up to about 40 h.p., the largest output likely to be required. By making the stator winding suitable for series-parallel connection the range of 200 to 500 volts can be covered with two machines of each size.

Acknowledgements are due to the British Thomson-Houston Co., Ltd., for the photographs and diagrams used to illustrate this article.

Breakdowns Caused by Vermin.

By E. Ingham, A.M.I.Mech.E.

SOME of the most disastrous breakdowns of electrical plant have been the result of short-circuits caused by rats and mice. Mice in particular have a liking for the insides of electrical machines, probably because of the warmth afforded, and both rats and mice seem to have an appetite for insulating material. In one case of damage to the insulation of the stator winding of an induction motor as many as sixty-four dead mice were found in the space between the rotor-core plates and the shaft. They had entered the carcase during one or more stoppages of the motor, nibbled the insulation of the stator winding, and then passed through the holes in the end plates into the recessed part of the rotor core.

In another case three dead mice were found jammed between the ends of the armature and the commutator lugs of a semi-enclosed shunt-wound motor, and a fourth inside the armature. It is supposed that the mice had run into the armature during the night for warmth and, in trying to escape when the machine was started again, had been flung by centrifugal force to the periphery of the cavity between the commutator lugs and further, that the pressure imposed by the centrifugal force on each mouse was sufficient to squeeze the liquid from its body, so that the insulation was destroyed.

During the periodical inspection of a slip-ring induction motor an insurance company's surveyor on opening the terminal box (a casting measuring 8 in. by 6 in., fixed to the top of the stator frame) found it entirely filled by a rat's nest. The rat had gained entrance by the air vents in the end shield at the slip-ring end, thence through the passage-way between the stator core stampings and the frame, and finally through the holes for the leads at the top of the frame. It had gnawed away the insulation from the leads within the box, leaving them bare. The nest was removed, and it was recommended that the vents in the shield should be closed by expanded metal, but before this was done the rat paid a further visit and was killed by coming into contact with the terminals.

Rats not infrequently attack the lead covering of cables perhaps in mistake for lead pipes which they are known to gnaw through when in search of water. In one of the technical reports issued by a leading insurance company a report appears of damage to a cable at a quarter of a mile from the power station. This caused a short-circuit whilst the station plant, an 8,000-kVA turbo-generator, was taking the full load of the station, or 30 per cent. of its full rated capacity. As a result one of the eleven feeder circuit-breakers tripped, cutting off the fault, but the main circuit-breaker did not come into action. The whole of the insulation and bracing blocks of the stator end connections at the turbine end were destroyed, and the stator was completely burnt out. The cast-iron outer casing and one of the stator-core end plates were cracked by the heat. It was surmised that the sudden interruption of the load occasioned by the tripping of the feeder circuit-breaker caused a surge on the line, and the resultant excessive voltage broke down the insulation.

In one instance, owing to a mouse having entered a high-voltage cubicle at a main generating station, damage to the extent of nearly two thousand pounds was done, the city for a time being deprived of all electric light and power. On rare occasions cats have been the cause of short-circuits by climbing on to bus-bars or up to overhead conductors.

The best method of safeguarding machines against damage is to cover openings or ventilating spaces by fine wire netting or fine-mesh expanded metal. Cables may be rendered immune from attack by rodents by the application of creosote, the smoky smell and the taste of the oil not being relished.

Power stations which take their condensing water from tidal rivers and estuaries are liable to lose the supply, more or less, through accumulation of mussels inside the pipe lines. An effective remedy seems to be the continuous introduction of small quantities of liquid chlorine at the intake.

An account recently appeared in the Press of how a snake, 4 ft. 9 in. long, caused serious trouble in Australia. The reptile got into a 6,600-V cubicle *via* the cable duct, crawled up to the isolating links, incidentally missing the oil switch, and caused a "short" of sufficient magnitude to create a violent surge on the whole system, isolating the section affected at the breaker in the power house. It is believed that the snake was attracted by the a.c. hum. When it was discovered in the cubicle it crawled rapidly up over the instrument wiring and took its position between the oil switch and the face of the cubicle out of sight. It was eventually dislodged and killed after a struggle.

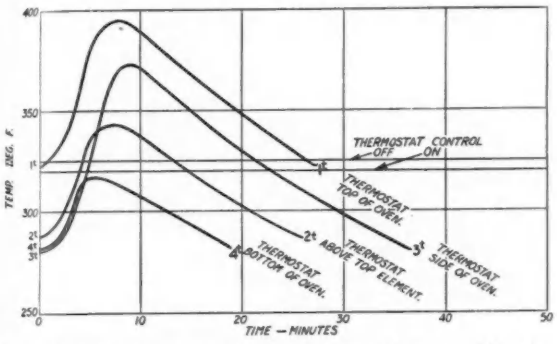
Automatic Cooker Control

A variety of opinions

AFTER considerable experimental work a representative of the General Electric Co., Ltd., believes that automatic cooker control offers no advantages except in the case of forgetfulness on the part of the cook. On the other hand, after issuing over 650 cookers with thermostatic control the Lancaster Corporation Electricity Department is of the opinion that automatic control will be standard within two years.

These two selected views indicate the present unsettled position within the industry regarding the future development of automatic oven temperature control, which is not surprising considering the present state of development. At all events, we think that a useful purpose will be served by summarising representative views in assisting the industry in making a decision in this most important matter.

Some advance has already been made in the direction of automatic control. For instance the Simplex Electric Co., Ltd., says that it is now enjoying some reward for its pioneering work, and the Lancaster Corporation tells us that although it provides " ordinary " cookers it has not sold one model since the adoption of automatic control.



Oven temperature test curves showing large " overruns " under automatic control (British Thermostat Co.)

Is automatic control a desirable development? Mr. E. E. Hoadley (Maidstone) considers that it is not from the cooking point of view. The South Wales Power Co. regards it in the light of an artistic refinement, while Mr. R. W. L. Phillips (Bedford) refers to probable publicity value. At Norwich they are doubtful whether it may not materially affect the efficiency and good working of the oven, and Mr. E. Seddon, Edinburgh, says that it will increase the initial and maintenance costs, as well as the loading.

Mr. F. Forrest, Birmingham, regards it as a normal, desirable and very possibly an inevitable development, while the attitude at Leeds is that as the gas industry has implanted the idea in the public mind the electrical industry will have to be in a position to offer its consumers the same facility. Mr. S. F. Bickell (Messrs. Falk, Stadelmann & Co., Ltd.) regards automatic control as a luxury which would also have some convenience and a certain sales value if the thermostat were cheap enough.

In the opinion of the Hotpoint Electric Appliance Co., Ltd., the development is unnecessary, although it would enable the use of higher loadings, and British National Electrics, Ltd., say that it would further complicate the position regarding hiring charges. The Revo Electric Co., Ltd., is keeping an open mind on the question, although Mr. Tonks referred to the movement as a belated effort to compete with gas automatic control, while Messrs. Belling and Co., Ltd., stress the necessity of catering for the housewife who wants to give less time and attention to cooking operations.

Messrs. Moffats, Ltd., think that the development will be favourable to the electrical industry. Arrow Electric Switches, Ltd., are of the opinion that automatic control is bound to gain favour here as it has done in the United States, and the Rheostatic Co., Ltd., favours it as being very superior to the three-heat switch for convenience. The British Thermostat Co., Ltd., points to the elimination of supervision and " Diamond H " Switches, Ltd., say that a great deal depends on the efficiency of present-day ovens, which is variable.

The Effect Upon Hiring Schemes

Because cooker development generally depends very largely upon hiring, the additional cost of the thermostat is probably the most important question at this stage, but it is almost impossible from our investigation to arrive at a fairly accurate figure in this connection. The Blackpool undertaking puts it at 10s. while Moffats say from £2 to £3; the B.N.E. from 20s. to 25s.; and the G.E.C. from 30s. to 35s. The British Thermostat Co. states that the price question is bound up with cooker design difficulties. The Brompton & Kensington Electricity Supply Co. thinks that manufacturers should not introduce an extra cost for an unnecessary refinement.

How far should the electrical industry be influenced by what has happened in the gas world? Mr. H. C. Lamb (Manchester) says that the introduction of gas thermostatic control has undoubtedly improved the position of gas undertakings, and Mr. Skinner of the Colchester undertaking says that gas has only achieved by this means what had already been achieved by the electrical industry. From Maidstone we learn that there has been no influence from the gas development, and that there have been cases in which gas thermostats have been discarded. Messrs. Moffats tell us that gas automatic control propaganda is greater in this country than elsewhere, and the British Thermostat Co. maintains that there is an enormous demand for gas thermostats. " Diamond H " Switches say that gas automatic control does not discount the advantages of electric cooking, and that it was introduced as a necessity to improve indifferent results.

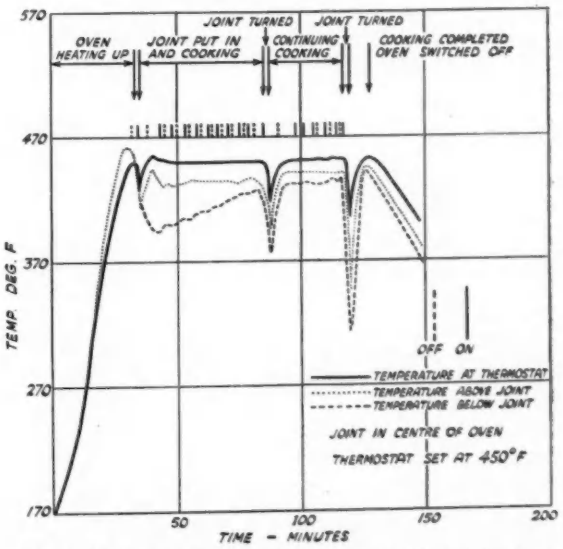
Many consider that automatic control is useful as a " selling point," and it was for this reason that Messrs. Albert Phillips, Ltd., started the production of electric cookers with automatic control as standard. The Revo Co. claims that the thermostat serves a useful purpose in selling against gas automatic control, and Mr. Howell, Ipswich, and the Blackpool Electricity Department express similar views.

Mr. F. Nicholls, of the Derby undertaking, says that automatic control might prove an advantage in selling although " pushing " it might be dangerous if it involved any radical departure from present cooker designs.

The Economies Claimed

In some cases the economy effected by automatic control is stressed. Mr. Struthers (Sheffield), as a result of recent experiments, is convinced that it is more economical to the user than switch control, and Mr. F. Forrest says that it prevents over-running and economises in energy, and that it would be of even more value applied to boiling units. Messrs. Moffats also mention the economy in consumption as well as reduced maintenance by the prevention of overheating. Mr. R. W. L. Phillips, Mr. N. McLean (Harrogate) and Mr. Coupe (Belling) all refer to the tendency of womenfolk to cook at much too high a temperature with hand control. The Blackpool undertaking points to economy in consumption mainly in commercial cooking.

At the Police Orphanage, Harrogate, comparative tests on two Jackson commercial-type ovens, one automatic and one hand controlled, under precisely identical conditions, showed an energy saving effected by the thermostat of 43 per cent. during four weeks. Whatever the results of automatic control, they are, of course, brought about by constant temperature. But this is cited in some cases as a disadvantage in that if the control is left on for too long a time then the maintained temperature results in food burning. The Electricity Board for Northern Ireland stresses this point, and Mr. Tonks (Revo) and Mr. Whitehead (Croydon) both



Controlled oven cooking cycle test curves (Rheostatic Co.)

consider that with automatic control there is a case for time control as well.

It seems to us that little information is to be gained from actual cooking tests, for a good cook will secure good results from either automatic or hand control. A lady demonstrator of the Westminster Supply Corporation told us she had tried automatic control for several months with different makes of cookers; the results were good, but no better than those obtained with hand control, and she therefore considered the thermostat unnecessary. A similar report comes from South Wales, and it is added that the additional expenditure of automatic control is unjustified unless the housewife really wants to leave the cooker to its own devices while she goes shopping.

Mr. Lamb says that, after unsatisfactory results in the past, tests on more recent thermostats appear likely to prove satisfactory, but behaviour on circuit is important, and experience on this point is not yet available. From the Birmingham undertaking we learn of the satisfactory performance of a cooker whose design incorporates automatic temperature control and of promising results from an old cooker fitted with a thermostat.

Referring to tests on standard Jackson cookers, Mr. A. J. Newman, of the Bristol undertaking, says that the thermostat makes a very strong claim for use as an addition to a standard cooker, without appreciable modification. From the more technical point of view test curves taken by the Rheostatic Co. show quite different results from the same thermostat for several different makes of cookers of good design, while curves of tests taken by the British Thermostat Co. show that an oven fitted with a thermostat sensitive to 5 deg. F. temperature change has, under certain conditions, a temperature control of the order of 70 deg. F. entirely due to overrun.

Infinitely Variable Control

Out of experience with automatic control has been born the idea of using the thermostat or similar equipment for infinitely variable control, for it is a fact that the thermostat gives this regulation as well. We have discussed the subject with a prominent North Country supply engineer, who is in favour of automatic control purely on this score. He has designed and had made a cooker which can be put out anywhere without regard to pressure drop.

The Colchester engineer (Mr. W. Frisby) wonders if closer regulation could not be obtained in a more simple way, such as, for instance, finer switching on the lower load, by which he suggests the advantages of automatic control could be obtained. Referring to their non-automatic cookers, which incorporate an oven grill, Messrs. Moffats say that with two three-heat switches it is possible to obtain good oven temperature regulation. "Diamond H" Switches think that the three-heat switch should be eliminated where a thermostat is fitted to simplify control and operation. At exhibitions during the last year or so we have seen cookers with both three-heat switching and automatic control displayed by Siemens Electric Lamps & Supplies, Ltd., and Tricity Cookers, Ltd.

Some people maintain that gas automatic control was merely introduced to overcome mains-pressure difficulties, and therefore the electrical industry should not concern itself with the subject. On the other hand, some electrical men think that the thermostat will be useful in view of the increasing voltage-regulation difficulties in rural areas. But Mr. A. E. Knights, Bury St. Edmund's, contends that the various forms of voltage-regulating equipment now available will achieve more towards satisfying the cooker user.

Mr. S. C. Hurry, Jackson Electric Stove Co., Ltd., suggests that the only case in which the thermostat would help considerably is where supply pressure is doubtful, for in such a case a bad cook would get better results. He is doubtful about the results from the good cook, however, because the equipment as a whole would not be so flexible. Lancaster Corporation makes a special point of the advantage of automatic control with varying voltage. The Manchester Electricity Supply Department includes, among the advantages of automatic control, compensation for the effects of voltage fluctuation and element ageing, while Bristol and Brighton Corporations also look at this aspect of the subject.

Merits of Existing Methods

Much has been made in electric cooking propaganda of the excellent regulation by the three-heat switch. Carron Company maintains that this system is better than automatic control. Mr. Tonks says that, in effect, we have already had automatic control for six or seven years, but it has not been fully exploited. Croydon advocates two three-heat switches, and Mr. Whitehead claims that the "Croydon" cooker would hold 350 deg. F. at "low" indefinitely. Blackpool Corporation says that with three-heat control and suitable loadings a sufficiently steady temperature can be obtained for all practical cooking purposes, while Mr. E. Seddon considers that in a well-designed oven three-heat control gives almost perfect results, and his view is backed up by Brighton.

The North Metropolitan Electric Power Supply Co. says that while there is much to be said for thermostatic control it is averse to introducing anything which may complicate electric cooking, since with reasonable care very satisfactory results can be obtained with ordinary three-heat switch control.

Mr. Lamb refers to the drooping temperature characteristic of three-heat control, and says that while it is possible to devise a suitable switching programme, this must be altered for varying quantities of food. The Jackson Electric Stove Co. thinks that the thermostat has not appealed so much as was anticipated because so many operations can be carried on without it. According to the Northern Ireland Board, however, women are quite enthusiastic about the relief which controlled temperature affords them. Birmingham says that the present system gives perfectly satisfactory results, provided there is intelligence, tuition and experience. Although Mr. Nicholls considers that automatic control will eventually become general, he thinks that it would be a mistake to place too much importance upon its adoption because the public have accepted the claim that three-heat control cooking is automatic. The Rheostatic Co. says that the three-heat switch gives either a rising or a falling curve, and that it is difficult for the average woman to grasp the significance of this fact.

Apart from the broader commercial considerations, probably the thing which is concerning manufacturers most is whether automatic control would bring with it a call for any serious change in design, and in this connection we have in mind the modifications recommended by Igranic Electric Co., Ltd., to which we have already referred. It will be recalled that the chief points in the Igranic scheme are higher loadings for initial heating, thermostat switching in two steps and steam ejection. The Leeds undertaking thinks that while some attention will have to be given to the arrangement of elements no serious alteration in design will be necessary. Lancaster Corporation considers that it will be unnecessary to increase loadings, while Bristol does not favour the idea of loading increase owing to possible distortion and hot spots.

Heating-up Time

The Northern Ireland Board tells us that in its original request for automatic control they suggested to the manufacturers that this feature would enable the oven loadings to be substantially increased and so reduce the heating-up time, but the manufacturers showed little enthusiasm for the idea. Messrs. Moffats stress that their loadings are the same with or without thermostatic control, and Messrs. Belling do not agree that higher loadings are necessary.

Manchester Corporation would like more rapid pre-heating and compensation for voltage fluctuation, but without considerable modification of the oven structure. Mr. E. E. Hoadley thinks that automatic control would bring about higher loadings, and Carron Company considers that automatic control would have a decided influence on cooker design. The Revo Co. is emphatic that its own cookers, at any rate, will not need modification, as at low-heat cooking temperature can be maintained for the time required for each class of cooking. The Jackson Co. makes a strong point of low heat reserve: if the oven has a big reserve heat then thermostat control is more difficult than with low reserve and greater flexibility.

The Rheostatic Co. believes that in this question of design there should be co-operation between the makers of cookers and thermostatic controllers. The British Thermostat Co. thinks that the loadings now offered are satisfactory, but that the speed of heating-up would be greater if oven interiors were lighter.

Blackpool Electricity Department says that automatic control would involve re-designing the oven to allow for adequate steam ejection. Generally, however, steam ejection has been dismissed by the contributors to this study as an idea which is not necessarily coupled with automatic control. Fewer people have talked about thermostat design than about oven design. Messrs. Jackson's conclusion is that the thermostat has arrived at a stage of development when it can be well recommended, but experience at Edinburgh tends to show that oven thermostats become unreliable after being in use for some time. Lancaster Corporation is of the opinion that the bi-metal thermostat is more reliable than the mercury-switch type, and Carron Company says that attendance and hand control are both required with the present form of automatic control. Messrs. Belling suggest that the thermostat should be calibrated so that no further adjustment is required.

Blackpool reports that a number of gas thermostats have been discarded owing to unreliability. Mr. Struthers considers that the thermostat dial, instead of being numbered, should be clearly marked with the various temperatures to be

Electricity in Agriculture

A Conference at Rothamsted

A CONFERENCE on the uses of electricity in agriculture was held at the Rothamsted Experimental Station (Lawes Agricultural Trust), Harpenden, Herts, on January 29th. In introducing the chairman, SIR E. JOHN RUSSELL, director, explained that the electrical installation at Rothamsted, which had been provided by the General Electric Co., Ltd., was more elaborate than the farmer would need because it was designed for research purposes. The coming of electrical machinery on to the farm was not a new terror, but an added convenience. Farmers need not be electricians, for electrical machines did not go wrong and the less the farmer knew about electricity the better.

SIR BERNARD GREENWELL (who, while he is chairman of the County of London Electric Supply Co., is also a stock farmer) was chairman of the conference. He pointed out that the application of electricity to agriculture had assumed a new aspect since the establishment of the grid. Transformers had become cheaper, so that the cost of tapping high-voltage lines was falling, and electricity was becoming widely available in areas remote from power stations.

The laboratories of the Rothamsted agricultural experimental establishment and (right) "Red Gables," where the conference was held. The stone in front of the laboratories was erected to commemorate fifty years' continuous work

How Electric Power is Used

MR. M. M. HARVEY (agricultural development officer, S.W. & S. Electric Power Co.) spoke of "Electric Power: How to Obtain it and How Best to Use it." He remarked that the farmer was now getting used to electricity, so that his attitude had changed. He welcomed overhead lines near his property and when obtaining wayleaves the Shropshire Co. had had to resort to arbitration in three cases only. To supply a farm which was not near a distribution line necessitated the provision in most cases of a small village type of sub-station. Tariffs were based on that fact, but there were several ways of imposing the fixed portion of the charge. Usually the farmer was asked for a contribution toward the cost of the sub-station, or to guarantee a certain consumption.

In his area poultry and dairy farms (which used from 2,000 to 7,000 kWh each per year; one farm consumed 17,000 kWh) utilised much more electricity than other kinds of farm. The yearly average of twenty-nine farms was 4,000 kWh. Poultry farming was a speciality and dairy farms were more like factories, so that their consumptions were greater than those of general farms.

In enumerating the various uses of electric power Mr. Harvey mentioned that electric vehicles were coming into use near towns. Mixed farmers installed more motor h.p., but work was seasonal so the use made of the machines was less than on poultry and dairy farms. Hop farms were installing more machinery with electric drives; their consumption was good, but seasonal. Hop kilns were used also for drying grass.

It paid to have a good installation and the use of electricity in the farmhouse often provided the urge to employ power on the farm. Mr. Harvey was rather partial to the use of all-insulated fittings with t.r.s. cables; the conduit system was stipulated for power circuits. Portable floodlighting was coming into use, particularly for sheep tending. Pumping was in general use, and the 5- to 12-h.p. corn grinder was the most used barn machine. The tendency was to employ unit drives on all but the smallest farms.

Since in many cases four-wire distribution was not really worth while, single-phase motors were now in more general use; starting troubles had been overcome. Large incubators were in greatest demand, but brooders were not so much used, as chicks were being put out to grass again.

Motor v. Fuel Power

DR. B. A. KEEN explained measurements which he is carrying out jointly with Mr. G. H. Cashen at Rothamsted with the object of comparing oil fuel and electricity as a source of power. The function of the tests was to obtain average figures under commercial conditions. The results were pre-

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Automatic Cooker Control *(Continued from preceding page)*

obtained. This idea is being adopted by the Lancashire Electric Power Co. The Rheostatic Co. claims to have designed a thermostat that will not only give control of temperature but also of cooking conditions. The British Thermostat Co. thinks that the requirement of comparatively low initial cost fixes the type of thermostat as one that makes and breaks a single circuit, while the Igranic Co. claims for the dual system closer temperature regulation and economy in consumption.

The greatest fear of many supply men is that if they adopt automatic control existing consumers may demand the scheme, raising serious difficulties. Ipswich is apprehensive regarding the probable cost, not so much on account of the thermostat, but because, they say, once a cooker is brought back to the workshop it must be modernised generally. Every cooker now returned at Harrogate is fitted with automatic control and reissued at the same rental.

Mr. Forrest thinks that the possibility of dissatisfaction should not weigh with the supply section in studying the question. From Norwich we learn that with automatic control it may be necessary irrespective of net cost, to fix rentals sufficiently high to avoid undue competition with existing cookers, and Mr. Hoadley thinks that, if boosted by the electrical industry oven control would give a great deal of difficulty to the supply authorities and very little advantage to consumers. The Northern Ireland Board is prepared to meet difficulties in some measure by applying thermostats to existing cookers for a slightly increased rental. Messrs. Moffats do not believe that automatic control would raise any great difficulties in respect of existing consumers, but they think, however, that it might be better to limit thermostatic control to hire-purchase for a year or so. Diamond H. Switches are sure that the introduction of automatic control would definitely raise difficulties in respect of existing consumers used thoroughly to the three-heat manual control switch which is a standard feature of most cookers.

As to the suggestion that the increased cost of automatic control could be met by increased hiring charges, Mr. Seddon is of the opinion that these charges will not bear any increase in view of the keen competition with gas. The Leeds undertaking sees no difficulty as it confines automatically controlled cookers to hire-purchase. The Lancaster Corporation says that difficulty may arise with cookers on hire, but that should not be allowed to retard progress.

The foregoing opinions appear to cover all the principal points in the controversy. They will no doubt give many of our readers food for thought and encourage them to send us their views on the subject.

liminary, rather than final or precise, as the tests had not yet been completed.

For threshing at the rate of two tons of grain per hour without differentiation between wheat, barley, or oats, 8 kWh was the equivalent of 1.36 gal. of paraffin, or, say, 10 kWh was the equivalent of 1.7 gallons, excluding lubrication and the petrol used for warming up before changing over to paraffin. The tests were deliberately made at a drum speed lower than that for which the machines were designed. There was no evidence that the smoother motor torque gave any better quality of grain, but the feeding rate with the motor was 4 per cent. less, for which Dr. Keen was not prepared to state a reason. The machines were operated at 50 per cent. efficiency, so that if smaller plant were used a lower figure than 1.7 gallons might be obtained.

Using a 20-h.p. motor and a 10/20-h.p. tractor, each at half load, the charges for one hour's threshing were 16.2d. and 19.5d. That was for the motor: 11.4d. (8 kWh) and 4.8d. overheads; for the tractor: 10.1d. (fuel plus oil) and 9.4d. overheads. Using a 5-h.p. "Drumotor" and a 6-h.p. Diesel engine, each at 5-h.p. output, the charges for one hour's grinding were 8.29d. and 8.02d. That was for the motor: 6.55d. (electricity) and 1.74d. overheads; for the Diesel engine: 2.52d. (fuel and oil) and 5.5d. overheads.

From the point of view of capital cost of plant, special attention was directed to the reversal of the ratio of fuel to overhead cost in the two cases quoted. For grinding 10 kWh was equivalent to five pints of fuel, but the price of oil varied with the size of container from 1s. 2½d. to 5d. per drum. Dr. Keen did not consider the unit motor necessarily to be the most efficient method of driving farm machinery.

Motor Drives

MR. F. E. ROWLAND (G.E.C.) read a paper on "Electric Motors for Farm Machinery," emphasising that their overload capacity was materially greater than an engine's 10 per cent., and that the efficiency of a motor did not fall appreciably when used at low loads. Consequently the cost of running was proportional to the amount of work done.

Single-phase machines were used up to 1 h.p., three-phase squirrel-cage from 1 to 7.5 h.p., and slip-ring over 7.5 h.p., largely governed by the maximum starting current permissible. A recently introduced motor was totally enclosed with a cowl containing a cooling fan covering part of the frame. A 3-h.p. totally enclosed squirrel-cage machine had the same frame size as a 7.5-h.p. protected type, and the prices of the two were similar, while the use of a slip-ring motor in place of a squirrel-cage machine necessitated a considerable increase in price.

The type of starter employed was governed by the maximum current permissible. All machines above 0.5 h.p. should have overload and no-volt protection. Low-speed machines were cheaper; the most economical speed as regarded first cost was approximately 1,400 r.p.m. Most farm motors ran at 960 r.p.m., which speed reduction did not materially affect first cost.

Installation Wiring

After luncheon MR. C. A. CAMERON BROWN (Institute for Research in Agricultural Engineering, Oxford) spoke on "Wiring and Earth Leakage." He advised the employment of good-class contractors and the avoidance of non-reasoned estimates.

In explaining how and why the various available systems of wiring differed from one another, Mr. Brown said he considered the all-insulated system best for farm conditions, with local earthing of motors and machines. He did not recommend an earthed system for farm wiring. Lead-sheathed wire in contact with wood, particularly oak, was liable to deteriorate through chemical action when the earthing of the system was badly carried out. Sheathed and braided tough rubber cable was now available which was less liable to harden and crack when exposed to strong daylight.

With the aid of a demonstration board Mr. Brown explained the working, and advantages of employing, small earth-leakage trip switches in place of fuses. The G.E.C., Nalder Bros., and Reyrolle types were demonstrated, the last-mentioned incorporating a testing device for ascertaining whether the switch was functioning properly or not.

Discussion

In the afternoon discussion MR. A. H. RANKIN (North. Met. E.P.S. Co.) remarked that nothing seemed able to compete with electricity, provided it could be obtained at the right price. His company had recently reduced its tariffs and in future motor power could be reckoned as 1d. or ½d. per kWh without the addition of a percentage of the standing charge. The latter was only imposed on a part of the supply (*i.e.*, lighting) and should not be spread over the total consumption.

He agreed that portable motors were of no real value at all on farms; their use had been merely a "phase." Electric soil-heating cable was not likely to be used much on a large scale. At ½d. per kWh electrical sterilisation of milk utensils was expected to create a large load. He would like to see earth-leakage trips cheap enough to be used on the appliance itself, rather than in circuit, so as to avoid one fault shutting down several appliances.

MR. J. I. BERNARD (E.D.A.) considered that earth-leakage trips would become standard in time, but for the present farmers could rely on guaranteed wiring done by contractors of repute. Manufacturers were apt to over-estimate the h.p. needed to drive farm machinery. Motors had a greater overload capacity than engines and their efficiency was greater at low loads. Because farm motors were hardly ever used continuously their employment would pay even with power at 2.5d. per kWh. Of the 20 per cent. guarantee only 5 per cent. should be allocated to the service cost, for the remainder paid for current consumed.

MR. H. B. JENKINS (Bedford) said that nearly 300 farmers in his area used electricity. When they used engines a skilled man had to be employed to look after them, whereas any boy could start a motor. He would always deprecate the fixing of lead-covered wiring to oak beams, even if it were efficiently earthed. From time immemorial churches had pitch pine placed between their oak roofs and the lead covering on the exterior.

MR. R. B. MATTHEWS considered that electric power costing less than 2d. per kWh was cheaper than the use of oil engines. The farm supply transformer should be just large enough for the normal load, while transportable temporary equipment should be made use of for threshing and other extra seasonal tasks. He hoped that a real attempt would be made to solve the electric ploughing problem in this country. "Ite" cable seemed a little better than the cab-tyre sheathed class.

COL. S. WALEY COHEN thought it unwise to be indefinite about capital cost. It was better to be straightforward, admit the service cost, and ask for a contribution towards it. Experience on his farm showed that a 20 per cent. guarantee was too high for the first year; 17.5 or 15 per cent. would be sufficient, and also that anything over 1d. per kWh was too high for the running charge. The farmer would be well advised to think out the most convenient arrangement for himself and then employ a good designer to lay out the necessary wiring most economically.

MR. J. R. MOFFATT (Rothamsted) drew attention to the usefulness of very small motors for numerous operations in place of hand labour, which cost very much more.

SIR BERNARD GREENWELL considered it to be the duty of supply authorities to see that farmers obtained good-class installations. Regarding the claim that electricity for ploughing would cost 2s. per acre, he said his own ploughing was done at a cost of 1s. 2d. for paraffin. His experience of electricity undertakings showed that one kWh cost 0.9d., of which 0.35d. represented interest, 0.2d. depreciation, 0.1d. rates, and 0.125d. the cost of generation. If the cost of electricity were halved the difference would be so small that no one would notice it. If the 28,000 kWh which Mr. Harvey stated had been used for crop drying had been used off peak the cost could have been much lower.

Aluminium and Corrosion

RECENT developments in the protection of aluminium from corrosion were inspected by us during a visit to the works of British Anodising, Ltd., at Merton Abbey, S.W. Here the Sheppard electrolytic process is applied (at 12 V and at temperatures not exceeding 212 deg. F.) to the metal and its alloys with a view to forming an amalgam with the surface. Tests, both under working conditions and under artificial acceleration, have shown the coating to be highly resistant to salt atmospheres, sea water, industrial fumes and certain chemicals. It is claimed that as the coating becomes an integral part of the metal, it cannot chip, crack or peel. It also offers considerable resistance to surface scratching, the degree of hardness being variable from the equivalent of chromium to that required to ensure ductility enough to enable treated sheets to be pressed into deep shapes. In view of the high heat resistance of aluminium oxide, the coating has a higher melting point than that of aluminium, which is 1216.4 deg. F.; this with its abrasion-resisting qualities enables it to be used for engine parts and the usual tolerances need not be exceeded.

Apart from these mechanical qualities, the process can be used to give a durable coating of any colour, translucent or opaque, polished or matt. Among the articles that we saw under treatment were electric lamp standards and other fittings for decorative purposes. The electrical resistance was said to be high, but no data of results under working conditions are at present available. Black or other dark coatings, we were informed, give a considerable increase in heat absorption over ordinary aluminium, indicating a scope for anodising in connection with utensils for electric cookers.

Meetings and Discussions

Micro-ray Communication

Ultra Short Wave Radio Distribution Problems Electricity Supply Law

THE paper on this subject by Messrs. W. L. McPHERSON and E. H. ULLRICH, to which reference was made last week, was discussed at the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 30th. The opening speaker, PROF. C. L. FORTESCUE, said that the description of the actual mechanism of the oscillation given in the paper depended on the argument that in some circumstances those electrons which succeeded in getting across the space in the shortest time arrived with the lowest velocity. That sounded like a paradox, and it was an explanation which he could not accept, because it was incomplete. The authors stressed the symmetry of the grid spiral, but if it were strictly symmetrical one would imagine that it would be a little difficult for the oscillation to know which way it was to build up on the 19 cm. which constituted the wavelength. Of course, a magnetic field was set up by the current in the filament, but it almost seemed as if the oscillation were longitudinal to the grid spiral and that there was some fortuitous lack of symmetry rather than exact symmetry. The summing up by the authors of the relative advantages of the ray system and the parabolic reflector seemed to be a purely scientific balancing up of the pros and cons, and a conclusion was reached which was in no way disturbed by the consideration of patent rights! Regarding the possible use of micro-rays in therapeutics, Prof. Fortescue suggested that the time was ripe for a closer liaison between the Institution and the Medical Research Council.

MR. A. J. GILL said the authors had not stated why they had selected their particular type of generator. In the Post Office they had got down to 25 cm., using magnetrons without modulators, which introduced some difficulty. At the same time it was possible to use more power with the magnetron. Fading in micro-ray circuits might be due to diffraction or dispersion. The Post Office had been working over exactly the same distance as that mentioned in the paper, *viz.*, 37 miles, between Scotland and North Ireland with waves of the order of 4 to 6 metres with six radio channels working in each direction and the experience had been the same, namely, that over the optical range there was no effect except fading. These particular circuits had been working for 12 months quite satisfactorily. It seemed that the cost of a micro-ray system might be a little higher, chiefly because of the structural work such as towers, &c., and the large reflectors, as compared with the comparatively cheap type of antenna used with short waves. On the other hand, the system gave much greater privacy. A commercial service on ultra-short waves between Shaftesbury and Guernsey had been in operation for a few months and the service had been satisfactory during the summer, but there was fading during the winter over optical paths and the service was not then workable. Curiously, however, the fading with the micro-waves used by the authors was in the summer and not in the winter. The use of ultra-short waves for therapeutic purposes was a serious nuisance to the communication services.

MR. E. S. BYNG remarked that the fact that fading did occur showed the importance of carrying out tests under operating conditions. The Air Ministry, on the commercial circuit, had permitted day and night tests to be carried out and had thus obtained information which otherwise would not have been available. A few years ago it was thought that short waves of, say, 8 metres would not proceed any considerable distance beyond the horizon, say, 8 or 9 miles, but recently it had been stated that television tests made in Berlin had been received in London fairly strongly and that 7 or 8 metre signals in America were also received here, which demonstrated how ideas were having to be adjusted.

MR. A. H. REEVES referred to work which had been done with an alternative type of receiver of the superheterodyne type which had been tested across the Dover-Calais link mentioned in the paper. This receiver on such wave lengths gave a better signal/noise ratio than the ordinary micro-ray receiver and was, in fact, between 15 and 20 decibels better than the maximum obtainable with the other type of receiver. However, it was not used in practice because a rather large number of tubes was required and it was more difficult for unskilled operators to use.

MR. E. C. S. MEGAW said that it was possible to consider an increase in power of the order of ten times to enable the reflector diameter to be reduced to one-third for the same signal/noise ratio. A smaller reflector would make mast design easier, and in some respects it seemed that higher masts would improve the circuit. Comparing the magnetron valve with that described in the paper, Mr. Megaw said that the former for a wave length of 25 cm. was a commercial article, and it had approximately four times the output and three or four times the efficiency of the valve described in the paper. Its filament consumption was about the same, but it required a high anode voltage and a low current, as compared with a low voltage and high current in the case of the micro-ray tube. There was a disadvantage in first cost in the case of the magnetron but a very useful life counterbalanced the high initial cost. The expense of the magnetic field which had to be produced had been exaggerated and the power required, about 5 W, was negligible in any communication system. Alternatively, there were permanent magnets available which, in many ways, offered a simple and satisfactory solution of this problem.

MR. W. T. GIBSON commented on the manufacture of the valves and spoke of the difficulty of testing owing to the formation of a stationary wave pattern around the apparatus, which forced the operator to remain stationary, as any movement of his body would affect the wave pattern and alter the readings. MR. R. WATSON WATT stated that the urge to increase the number of communication channels to be worked continuously and independently was such that they were being driven towards the high-frequency end of the radio spectrum where the problem of frequency stability would increase at a very alarming rate. MR. J. F. SHIPLEY referred to the novelty of meteorological matters being discussed in a paper on an electrical subject.

MR. W. E. BENHAM expressed the view that a number of troubles in connection with valves would be overcome by a type known as the "Acorn," which was of American design. MR. H. ARCHER THOMSON considered that experience seemed to show that the "Acorn" valve did not give very good results as a receiver on a 25-cm. wavelength, whereas the magnetron did. In the case of the magnetron with 50 per cent. linear amplitude modulation, the frequency-spread was of the order of ½ per cent. without any sort of compensation. MR. W. J. BROWN suggested that the authors had been very modest in their list of possible applications of micro-rays. Installations could be kept operating during fog without interference.

There was only time for Mr. McPherson to make a few comments, and his full reply will appear in the Institution *Journal*.

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Modern Urban Distribution

AT a meeting of the London Technical Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION, in London on January 27th, a discussion on "Modern City and Urban Distribution" was opened by two speakers, who explained the methods employed respectively in a dense area in the centre of London and the area of a large power company having considerable urban and rural areas. MR. W. J. JEFFERY (Charing Cross Electric Supply Co.) said that in his case, while the load density at present was 28,000 kW per square mile, double this density had to be allowed for. To this must be added that of other companies operating in the same area, which brought the present load density up to 70,000 kW per square mile.

Change-over to a.c. was carried out when a d.c. feeder became fully loaded. New consumers were, as far as possible, put on a.c., and the consumers in general were classified as follows: (1) Large buildings where a transformer station was essential, such as hotels and blocks of offices requiring from 500 kVA upwards; the largest at present in Mr. Jeffery's area included 4,000 kVA of electrode boilers and 900 kVA of transformers for lighting, &c. (2) Intermediate size premises not quite large enough for a transformer station, but requiring up to 250 kVA, which must, of necessity, have large l.v. services and 0.3 and 0.4 sq. in. 4-core cables. (3) Small premises, which must have separate services from the mains and could not be grouped together (in some cases small shops using lighting only). The cost of servicing such premises was very high compared with the revenue obtained.

Under the conditions applying in London sub-stations should be about 250 yards or 0.14 mile apart, and interconnection of the network was such that streets had alternative ways of being fed, while duplication of the 11-kV supply was also arranged for. The transforming stations on the Charing Cross Co.'s system were linked together on the 11-kV side as a ring, which was fed from a main sub-station and "broken" at the no-load point. Supply was received in bulk at the main

sub-stations at 22 kV and transformed down to 11 kV. For the main sub-stations 6,000-kVA transformers were chosen with a high reactance in order to reduce the short-circuit kVA on the 11-kV system, and, for the same reason, this system was "broken" in sections. At each sub-station there were ring-main oil-immersed isolators with an oil switch feeding the transformer, and each side of the ring was protected by an oil switch of 150,000-kVA rupturing capacity at the main sub-station. Up to eight transforming stations were connected to one ring, and up to the present time six rings had been installed.

On the l.v. system heavy cables and four-way 500-A and 300-A link boxes were standard. The boxes were so constructed that links or high-rupturing capacity fuses could be used on all ways. Feeder pillars were considered to be out of the question.

Mr. Jeffery expressed the view that earth-leakage trips for use in city distribution did not appear to have had full consideration.

MR. A. H. BENNETT (North Metropolitan Co.) said that in urban districts adjoining large towns the tendency was to change over to a.c. because it was much more flexible and economical. Where distances were considerable 33- or 22-kV feeders were laid to suitable centres, local feeders of 11 or 6.6 kV radiating to smaller sub-stations, the principal advantage of the lower voltage being that switchgear was considerably less expensive. E.h.v. feeders were often used in rural districts where distances between villages and small towns were considerable and comparatively light, inexpensive overhead lines of either copper, steel-cored aluminium, or even steel lines were suitable. As 11- or 6.6-kV switchgear was rather expensive it was sometimes more economical to link up the supplies to urban district areas by means of 3-kV cables where comparatively inexpensive switches or fuses would meet requirements, the ultimate distributor in all cases being three-phase, four-wire, at approximately 400 V between phases, and 240 V from phase to neutral.

To reduce expense in scattered areas voltage regulation should be effected, as far as possible, either from the generating station or a large sub-station where an attendant was constantly on duty, at any rate over periods of heavy load, and all high and extra-high voltage supplies from that point onward should be so designed that further regulation was not necessary. 3-kV supplies were usually given from comparatively short ring mains feeding approximately one or two dozen sub-stations within a radius of four or five miles, with isolating switches for certain lengths of feeders, and oil circuit-breakers fitted with overload trips to isolate portions of the network in the event of the failure of a cable.

Final distribution was usually by means of feeders radiating from a sub-station to feeder pillars, a distance usually of not more than 440 yards. It was more difficult to maintain balance on a three-phase four-wire system than on a three-wire d.c. system, and it had been found desirable that the neutral core should be of the same section as the phase conductors.

Mr. J. W. PERKINS expressed the view that the time would inevitably come when the house-to-house transformer system would have to be adopted with medium voltage distribution, which would make voltage regulation much more simple. Static balancers were not recognised so much as they should be, for they were cheap in first cost and low in running cost. Mr. Bennett said he had used static balancers to a certain extent for supplying a few country houses on the three-phase four-wire system with overhead lines, but they were only really suitable for long runs where it was necessary to balance at the far end. Mr. Jeffery said that he also at one time had hoped that house-to-house transformers would be the solution of distribution problems, but in his area that system was found to be impossible.

In reply to Mr. C. H. de NORDWALL, Mr. Jeffery said he had always fought against 11-kV "tees," and Mr. Bennett said he had used them as a matter of expediency, but they had never remained in service for more than three or four years.

Mr. W. K. LEWIS spoke of multiple earthing and the difficulty of obtaining earth at all in some rural areas. Mr. W. F. ANDREWS remarked that the policy to be adopted in his area was that when any particular district was to be changed over the old d.c. system was to be entirely scrapped and a completely new a.c. system installed, which Mr. Jeffery said was the policy of his company also.

Mr. A. WATSON said that an easy way to reduce change-over cost was to wait until premises were empty and then act quickly before the new tenant came in. Mr. Jeffery pointed out that in an area like his own where there were so many Government and similar buildings changes of tenancy did not take place with much frequency.

Mr. F. W. PURSE, the chairman, said that many consumers believed that changing over was merely a dodge to push up their bills and he had gone to some trouble to find a reason for this discontent. One result of the change over to a.c. was an appreciable reduction of the voltage drop, so that the lamps, for example, especially the new ones provided, probably took a little more current. Moreover, one well-known make of electric fire which was labelled 2,000 W was found to be only 1,800 W on test, and when the new elements were put in the consumption was probably 2,050 W.

Regarding the latest Standard Specification for lead-covered cables, he said that his own staff was complaining that the reduced thickness of lead and paper insulation for 460 V was such that they could not handle these cables satisfactorily. He also had had cases of crystallisation of the lead now being used for lead-covered cables.

Mr. Jeffery said that his undertaking had decided to stick to the old 660-V Specification for lead-covered cables on account of the greater mechanical strength, remembering that cables were often handled by other men than the supply authority's own staff.

Mr. J. PARR-MORLEY (hon. secretary) supported views which had been expressed as to the desirability of using high voltage for ordinary distribution with transformers on the premises. There were very satisfactory 3-kV fuses and he saw no reason why they should not be put in like ordinary fuses. He urged supply companies to keep in touch with building estate developments and, by being first on the job, lay their cables before building operations started. Then cable laying machines could be used.

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Electricity in Mining

Mr. A. W. WILLIAMS, president of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS, dealt with the importance of the mining industry of the scientific application of electricity when he spoke at the annual social meeting of the Lothians and Fife branches at Edinburgh. The president said the mining industry was rapidly becoming more dependent upon the application of electricity for safer and more profitable working. He found during his visit to Scotland that the Association occupied a prominent position in industry. Mr. Williams presented a Past-President's Medallion to Mr. Augustus Carlow, who reviewed the developments of electrical engineering in recent years. Among other speakers were Mr. A. B. Muirhead, West of Scotland branch, and Mr. McNicol, Fife branch.

Electrical Legislation

"The Effect of Legislation and Regulations upon Electricity Distribution" was the subject of a paper read by Mr. W. FENNELL before the Scottish Centre of the INSTITUTION OF ELECTRICAL ENGINEERS at Edinburgh on January 28th. After dealing with the legal basis of public electricity supply, Mr. Fennell reviewed the early development of the central station with its isolated low-voltage distribution system (compulsorily underground) at a time when every discouragement was given to the establishment of large areas. Power companies commenced in 1900, he said, and the first provision for combination for generation and bulk supplies appeared in the 1909 Act. The effect of recent legislation (1919 to 1926) was shown to be almost entirely that of improving generation. This legislation, culminating in the setting up of the Central Electricity Board and the grid, left distribution in much the same legal position as in 1899. Undertakings were essentially what the law made them. Mr. Fennell demonstrated the paralysing effect of the 1888 purchase terms upon companies approaching the purchase date, and suggested remedies. He indicated the unsuitability of the 1926 Act (Section 39) with regard to provisions for companies with large areas. He brought out the effect of the grid tariff upon the form of retail tariffs, and suggested the potential advantages of the grid in encouraging new undertakings. The basis, growth and effect of the general regulations and overhead line regulations were traced in relation to equipment, and also as to consumers and their wiring, connection, and disconnection. The Electricity Commissioners' 1934 Regulations were discussed, especially in view of their proposed reconsideration. Mr. Fennell's paper closed with a list of distribution matters which it was suggested should be adequately dealt with in a consolidating and amending Act.

King George V

His late Majesty King George was a patron of the Institution of Electrical Engineers from the year 1921, when the Royal Charter was granted, to the day of his death. The Council, therefore, fittingly held a special meeting on January 30th at which a resolution was passed (it was confirmed subsequently at an ordinary meeting) placing on record a sense of profound loss sustained by the death of the King, and signifying unswerving loyalty to His Majesty King Edward VIII.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Private Plants for Garages

In his comments on private garage plants in your issue of January 24th Mr. P. N. Barnard states that no oil-engine manufacturer would quote running costs of ¼d. to ½d. per kWh for the plants referred to in my article of December 6th, but my figures were taken from publications of manufacturers. Nevertheless, the plant of which he gives details costs much more to run than that mentioned in my article.

Mr. Barnard's 2.25-kW set generated 7,035 kWh per annum (*i.e.*, 35.69 per cent. load factor) at a cost of £57 10s., or 1.96d. per kWh. My figures for a plant below 5-kW capacity were £9.9 per kW per annum, plus 0.419d. per kWh, so that a similar 2.25-kW set would cost £33 10s. 11d., or 1.14d. per kWh.

With Mr. Barnard's contention that, in making a comparison, average figures should be taken I quite agree, but a flat rate of 8½d. per kWh cannot be regarded as an average price. Nor would his two-part tariff of £11 2s. per kW per annum, plus 1½d. per kWh, attract consumers with a large amount of power installed and a load factor of 35.69 per cent. My figures were taken from about sixty garages in different parts of the country, and can therefore be considered as an average. I will agree that load factors of 35 per cent. are reached, but in only about 4 per cent. of the garages with which I have had dealings.

In my article I made reference to the simplest form of filter plant that can be obtained to give a degree of filtration to enable one to use five gallons of waste oil to one gallon of new oil. If the filter plant referred to by Mr. Barnard is used I agree that the ratio should be half and half, but what is saved on the filter plant is lost on the fuel costs.

Mr. Barnard gives the cost of public supply at £79 10s., but with a charge of £6 5s. per quarter, plus 1½d. per kWh, 7,035 kWh would cost £68 19s. 4d.

If the interest is taken at 4 per cent., as suggested by Mr. Barnard, instead of 5 per cent., the standing charge for a 5-kW set would be £9.3 per annum per kW instead of £9.9. This would, in the case quoted by Mr. Barnard, reduce the annual costs from £33 10s. 11d. to £32 3s. 11d., *i.e.*, 3.5 per cent. The insurance figures are those quoted by three different firms and cover an "all-in" policy for the plant. If one takes the risks and insures against fire only a lower quotation can naturally be obtained. S. F. OSBORNE.

Leeds, *January 28th.*

Distribution Efficiency

Quality and reliability are recognised as being essential to the commercial success of a supply undertaking. The regulations state definitely the + and − limits of voltage variations permitted, and these have to be adhered to. To achieve these results extreme refinements, however interesting scientifically, seem to be hardly necessary. Economic limitations are secondary to the regulations, in any case.

The generating staff would hardly think of the mains staff as martyrs between them and the consumers, although they no doubt have difficulty in coping with the heavy domestic loads. In well-managed undertakings, all the departmental staffs appear to do very well, and smooth running is the rule rather than the exception. W. E. PRITCHARD.

Leeds, *February 3rd.*

Two-part Tariffs

In a letter published in the ELECTRICAL REVIEW of June 15th last I advocated a fixed price for electricity to each householder, irrespective of consumption, based on the maximum possible demand of the electrical apparatus installed.

I see that Mr. W. A. Royle, of Sunderland, provides the wiring for complete installations, of from three to nine lamps (including maintenance), an electric iron, and 240 kWh per annum, at fixed charges varying from 9d. to 1s. 7½d. per week. If a consumer uses heavier apparatus the sum is increased by from 1s. to 1s. 6d. for cookers, by 6d. or 7d. for a fire, 9d. to 1s. 8d. for a water heater, 4d. for a wash-boiler, and 3d. for a kettle. These prices are the result of averaging out the known consumptions of the apparatus, and are such as to enable people living in small houses to have a complete all-electric home at a fixed weekly charge.

Why should the energy charge for electric fires be so much less than that for lighting when heating may be used only during a cold spell, which lasts for two or three days, about once a year? In that case fires are generally switched on when the system peak is at its height, as Mr. F. J. Elliott implies in his article which appeared in your issue of January 17th. Again, on at least one undertaking, the maximum demand occurs on Sunday mornings when everybody is cooking a midday meal.

One of the reasons for lighting charges being high is that the demand is on the peak, and in the above cases the heating charge should, theoretically, be as much as the lighting charge, at least during the winter.

The two following tariffs, suitable for domestic consumers, supplied by municipal undertakings are, I believe, original. Under the first scheme the rate of each consumer will cover *all* units consumed in proportion to the rateable value of his house, compared with the rateable values of all houses connected to the mains.

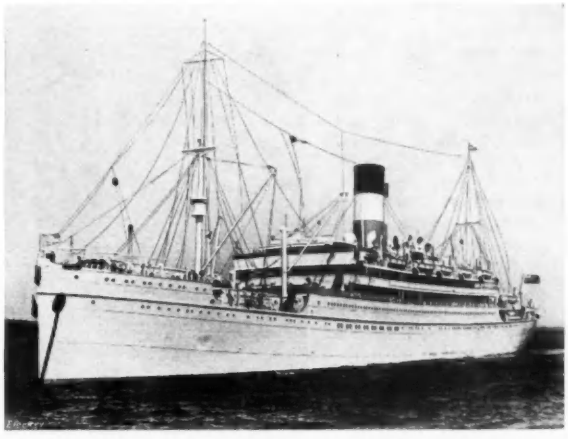
Thus, if A is the total quarterly selling price of electricity, including working costs, and all fixed charges adjusted at the end of each quarter in accordance with the total kWh sold by the undertaking, B the rateable value of a certain house, and C the sum of the rateable values of the houses connected at the end of the quarter, then the cost of current for a certain house equals $A \times B/C$ and the cost of current per £1 rateable value equals A/C. If A decreases and B and C remain as before, then the cost of electricity to a particular house goes down.

The second scheme requires one meter to register the total kWh consumed by all the houses in one street, each consumer in that street being charged in proportion to the rateable value of his house. This scheme is, in principle, similar to the other, but the street is taken as the base instead of the whole area of supply, the domestic consumers sharing the cost of electricity in proportion to the rateable value of their houses. H. L. TAYLOR.

Market Drayton, *January 28th.*

Electricity in a New House

I have been following the arguments put forward by Mr. Allford-Harding in your issue of January 24th and by others in your issue of January 31st, and I must agree with Mr. Allford-Harding that the "assurance of figures" that is often presented is very misleading, and often makes a newcomer into a district do something that he is very sorry about for a long time after. Both Mr. W. Phœnix and "Mere Engineer" talk glibly about halfpenny units, and a low fixed charge based on an equally low rateable value. The conclusion at which they arrive is not to be criticised, but in how many districts can halfpenny units be obtained?



This is the T.S.S. "Vandyck," the Lamport and Holt liner chartered by the Electrical Industries Benevolent Association for a cruise to Lisbon, Casablanca and Madeira commencing on August 22nd. As we stated in our issue of January 24th, full particulars of the cruise can be obtained from the Association at 36, Kingsway, London, W.C.2

In my district the rate is ¾d. per kWh with a fixed charge equivalent to 12½ per cent. of the rateable value. The district has been recently reassessed, and I have been informed that my rate is not standard, and a fixed charge has been proposed which works out at 13¾ per cent. on the new assessment. I fail to see what the rateable value of a house has to do with the cost of electricity.

Comparing the hypothetical house cited by Mr. Allford-Harding and my own case, figures may be interesting. I use electricity for lighting, also a 1½-kW fire, vacuum cleaner and iron. For gas I have a cooker, geyser, thermostatically controlled water heater, one large and three ordinary gas fires;

one of the small fires is used for nearly an hour every day throughout the year.

	£
Cost of electricity	8
„ gas	13
	21
„ coal	5
Total	26

Comparing these figures with Mr. Allford-Harding's, they show a slight increase, but he does not allow or provide for any heating beyond the amount of 1½ cwt. coal weekly for twenty-six weeks, whereas I provide for the heating of another room, and the occasional use of three other fires. If I changed my existing gas fires for electric it would only reverse my figures, for on my revised fixed charge, plus ¾d. per kWh, the total cost would remain the same; even putting my consumption of electricity up to over 4,000 kWh per annum would not get my cost below 1.2d. per kWh, so why talk about 0.65375d.

It has to be accepted that whilst the efficiency of the electric oven is equal in every respect to the gas oven, electric hot plates and fires are not to be compared with gas for speed, unless very heavy loading is used. B. MARTIN.

February 3rd.

In your issue of January 24th Mr. S. Allford-Harding gives about 4,000 kWh as the consumption in his "average working-class home," and he questions whether the ordinary weekly wage earner can afford the full use of electricity. Charges for such a supply in the area of Belfast Corporation, where the fixed charge is based on 18 per cent. of the rateable value would be somewhat as follows:—

Fixed charge	£3	1½	0
1,000 kWh at ¾d.	3	2	6
3,000 kWh at ½d.	£6	5	0
Total...	£12	19	6
Less 10% for prompt payment ...	1	6	0
	£11	13	6 net.

The fixed charge might be lower, of course.

In the area supplied by the Electricity Board for Northern Ireland, where the fixed charge is based on floor area, the account would be:—

Fixed charge	£2	6	10
2,000 kWh at ¾d.	6	5	0
2,000 kWh at ½d.	£4	3	4
Total...	£12	15	2
Less 5% for prompt payment ...		12	9
	£12	2	5 net.

The floor area charge might be even as low as 37s. 9d.

The cost per kWh and average weekly expense is therefore: Belfast, 0.7d. and 4s. 6d. per week; Northern Ireland, 0.73d. and 4s. 8d. per week. Therefore such consumers can be "assured by figures presented to them that a fuller use of electricity, as far as the cost of energy itself is concerned, is as readily within their means as any alternative."

Definitely Mr. Allford-Harding's figure of 1¼d. per kWh is very high and it is regrettable that a comparatively small consumer of electricity should write letters which do not indicate the true position and which might be used for anti-electric propaganda. F. R. UNWIN, M.I.E.E.

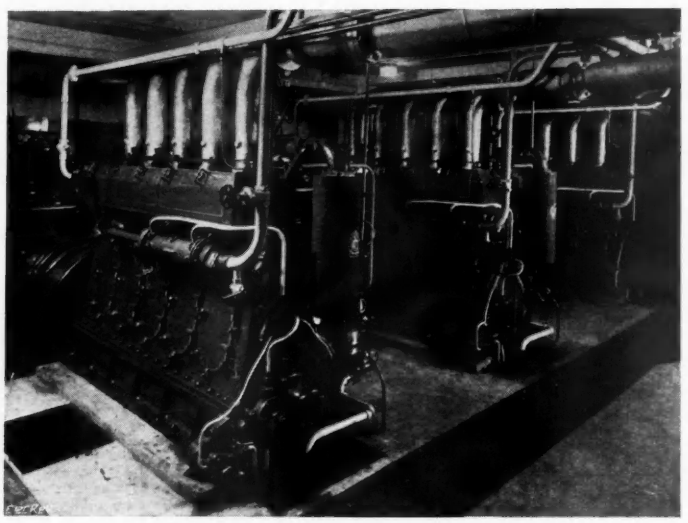
Craigavad, Co. Down, *February 3rd.*

Generating Plant in a London Store

THE new generating station which has been arranged at the Tottenham Court Road premises of Messrs. Heal & Co. contains four Diesel engines of the airless-atomiser cold-starting type. Two of these have five cylinders and are direct-coupled to 95-kW 440-V d.c. generators and a third with five cylinders is direct coupled to a 56-kW generator, all at 560 r.p.m. Thimble-tube boilers in the exhaust systems of the two larger sets, in conjunction with calorifiers, pre-heat the feed water required for the air-warming and hot-water installations.

The fourth generator is driven at 1,500 r.p.m. by a "Texrope" from a 350-r.p.m. single-cylinder horizontal engine. Its function is to run unattended to supply the night load, the only modification from standard being the lubricators, which are three times the normal size. The set can be started by hand in emergency.

A static balancer is associated with each dynamo to deal with 25 per cent. out-of-balance current. A 10-ton fuel-storage tank is buried in the yard outside. All piping is coloured in accordance with the B.S.S. recommendations. Jacket water for the three main engines is gravity fed from an 18-ft. cooling tower of the open, natural-draught type in a 16 by 12 ft. steel tank. The electrically driven pumps raising the water to the tower are not run during the night as two thermo-syphon tanks outside the engine room cool the jacket water for the small engine.



A general view of Messrs. Heal's generating plant

Provision has been made for the installation of a fifth set, as the present maximum load is 230 A at 440 V, and is steadily increasing. Lighting takes 60 per cent. of the total output. An emergency supply for inspection lamps can be taken from the public mains.

The switchboard consists of eight panels, and is lighted over its whole length by an adjustable horizontal reflector fitting. General illumination of the engine room is by twelve opal-glass ceiling fittings with chromium-plated mounts. This lighting system, with the aid of the reflection from the pale ivory distemper of the walls and the light jade green of the engines, seemed to us to be remarkably effective. Ventilation of the engine room (up to twenty changes per hour) is by plenum and extraction.

Noise and vibration were not apparent even in the rooms immediately adjacent to the engine room. The concrete engine raft (weighing 180 tons) was cast in one block and mounted on bound cork matting, an air gap being left between the engine bed and the site concrete.

The terms offered for public supply worked out at 2.09d. per kWh, while the overall costs with heavy-oil engines (allowing for anticipated extensions) are calculated to be 1.43d. per kWh. Among the extensions completed is that of the circular staircase going up four storeys from the basement to the Mansard Galleries, with its effective scheme of soffit lighting which includes ninety-seven 40-W horizontal tubular lamps as well as sixty-one 60-W vertical lamps at various points.

The scheme was due to Mr. G. S. Beale (secretary, Messrs. Heal & Son) and Mr. S. M. Barlow, managing director of Messrs. Barlow & Young, the main contractors, who were responsible for the design of the power station. The architects were Messrs. Smith & Brewer. Firms responsible for the manufacture or installation of the equipment were:—Messrs. Ruston & Hornsby, Ltd. (main sub-contractors and Diesel plant and accessories); Leslie & Co., Ltd. (concrete beds and building); Clarkson Thimble Tube Boiler Co., Ltd. (exhaust heat boilers); Power Equipment Co., Ltd. (switchboard); Lancashire Dynamo & Crypto, Ltd. (generators and motors); Johnson & Phillips, Ltd. (static balancers); Absorbit, Ltd. (cork insulation); Leach Electrical & Engineering Co., Ltd. (ventilation); Premier Cooler & Engineering Co., Ltd. (cooling tower); and Callender's Cable & Construction Co., Ltd. (cables).

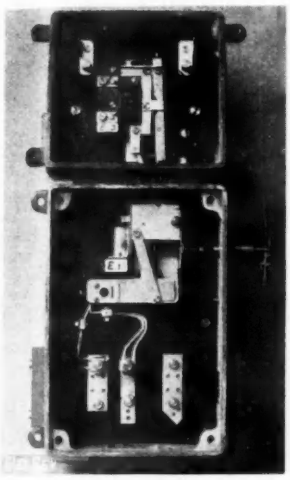
New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

An Earth-leakage Service Switch

The "Bullen" service switch is designed to interrupt the supply before an earth fault creates an unsafe voltage between a consumer's conduit or apparatus and earth, and to limit the value of leakage current in areas where the earth resistance is low to values well below those at which the fuses would blow.

It consists of a 50-A short-break a.c. switch, which can be tripped by the passage of an earth current of from 1 to 1.5 A through a wax thermostat. In order to prevent the voltage of operation with 30 mA exceeding 20 V, a vibrating magnetic relay can be employed which operates by a succession of impacts corresponding to 0.6 VA for ten seconds. Where the earth resistance is abnormally high, and even sensitive relays are ineffective, a relay which utilises a neutral conductor as a low-resistance path for the small leakage current (which is all that is required to trip the main switch) is employed.



The "Bullen" earth-leakage service switch

If a low resistance earth-leakage path consisting of a metallic conductor is available on the consumer's premises, *e.g.*, a cable sheath or light earth wire not exceeding ten to fifteen ohms in resistance, adequate protection is provided by the thermal trip (E.1), which is connected between this path and the apparatus. The magnetic trip, which is detachable, is added to the lower case only when necessary to comply with I.E.E. Regulation 1,005 C. If the low-resistance path is a small water service pipe, and is thus unsuitable for carrying a heavy earth current from a live conductor protected by a 50-A fuse, the thermal trip can be provided with a shunt so that an earth fault exceeding, for example, 10 A, will trip the 50 A switch controlling the phase.

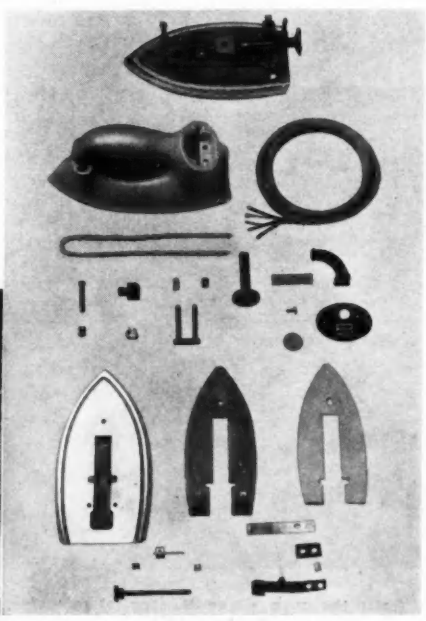
Under other conditions the main earth connection is made through the thermal trip to an earth electrode, and a supplementary earth is provided by a connection to the apparatus which is taken through the circuit of the magnetic trip to a second electrode. Thus the thermal trip provides a path for small leakage currents, but if the earth resistance is too high to prevent this, the voltage increase would operate the magnetic trip. The "Bullen" switch has been developed by the PATENTS MANAGEMENT CO., LTD., 7, James St., Liverpool, 2.

Small Domestic Appliances

VIDOR, LTD., West Street, Erith, inform us that they are introducing, in addition to the appliances described in these columns recently, the "Vi-door-lite," a small battery-operated light worked automatically by the opening and shutting of a door; a small 500-W radiator; and illuminated name signs for houses.

Recent "Stellex" Products

An ionisation unit (type M.10) for the treatment of rheumatism, gout, &c., and a transformer (V.20) for low voltage galvano-cauteries are new "Stellex" products available from MESSRS. C. H. BLACKBURN & Co., 2, Sandland Street, London, W.C.1.



The "H.M.V." thermostatically controlled iron and its component parts

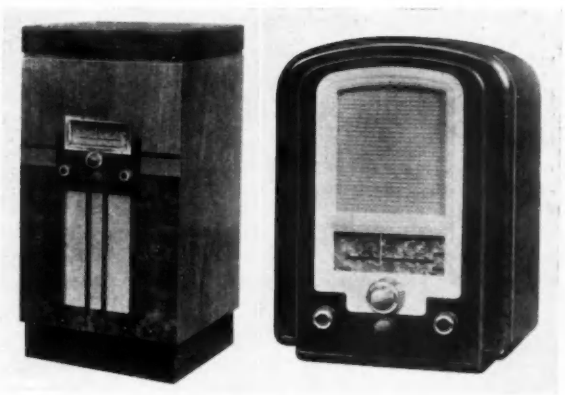
A separate terminal and rheostat are provided for a surgical lamp on the cautery transformer, which, measuring only 6 in. by 3 in. by 3 in. and weighing only 3¾, fits easily into a surgeon's handbag. Another recent "Stellex" line is a sealing iron for wrapping cellophane round bread, cakes, cartons, &c.

A Daylight Reflector Lamp

The "Boula" reflector lamp marketed by the BOULA REFLECTOR LAMP CO., LTD., 156, Charing Cross Road, London, W.C.2, is now available with daylight glass.

All-wave Radio Receivers

A range of all-wave radio receivers is being introduced to the market by MESSRS. FERRANTI, LTD., Moston, Manchester. It comprises four models, a "straight" three-valve set in single-tone bakelite, a three-valve superheterodyne "consolette" in ivory and brown bakelite, a "straight" three-valve console in walnut, and a three-valve radio-gramophone also in walnut.



The Ferranti straight-circuit radiogram and superheterodyne consolette

All the standard features are incorporated with the addition of an extra switch to enable the short waves of 19/51 metres to be received.

A Triode for Microphone Amplifier

The latest development in radio valves by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, is the type "MH40" triode for microphone amplifiers. It is indirectly heated and is suitable for the initial stage of high-gain amplifiers, special features being its low order of microphony and background noise owing to the particularly rigid electrode construction and the use of steatite electrode insulators.

A "Streamlined" Iron

A "streamlined" thermostatically controlled iron is the latest contribution of H.M.V. HOUSEHOLD APPLIANCES, LTD., 363, Oxford Street, London, W.1, to the domestic market. The design of the handle enables it to be held comfortably in either the left or right hand, two thumb rests being provided. The chromium-plated sole-plate is specially shaped to allow easy ironing between and under buttons and to travel as easily backwards as forwards. The heat is evenly distributed right up to the actual edge of the iron.

A three-position switch incorporated behind the handle provides heats suitable for all classes of work, and the makers claim that the iron heats up four to six times as quickly as an ordinary model. The desired temperature is maintained by means of a thermostat to within plus or minus 10 deg. C.

For the body and handle of the iron primrose-yellow porcelain is used. Besides being an insulating material, this has the additional advantage of being able to be kept clean easily. The weight of the appliance has been so distributed that it feels much lighter than its actual 5¼ lb.

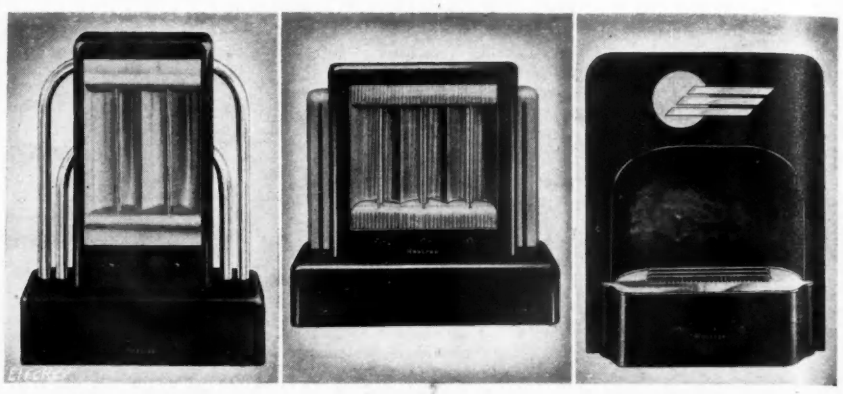
The nichrome V 800-W tape element is wound on a former of pure phlogopite amber mica and is cased in sheet steel. There is no detachable connector, a heavily rubber-cased cable entering the rear of the handle.

D

Reflector Fires

A range of reflector fires recently introduced by HEATRAE, LTD., Heatrae Works, Norwich, comprises a number of models which have the rod fire-bars arranged on specially constructed floating contacts. This allows freedom for expansion, and the fires may be handled with less likelihood of damage because the floating contacts act as shock absorbers. The fire bodies are made of steel, with welded joints and rounded corners, while the reflectors are chromium-plated.

Massiveness and modern sharp lines characterise these fires, three examples of which are illustrated. A 2-kW loading is standard, and 3-kW optional on some. In the "Trophy" the fire-bars are placed horizontally, the reflector being so arranged that the heat is projected forward, the red glow from the elements showing on the hammered copper reflector. The "Majestic" has lamps inside the fire to throw a red glow on to the silver-finished side panels. The reflectors and surround, however, are chromium-plated.

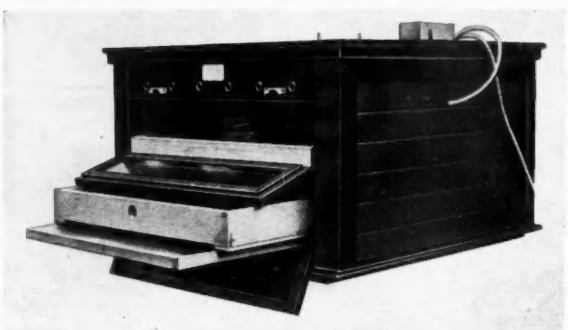


Three "Heatrae" fires of very modern design—the "Olympic," "Majestic" and "Trophy" models

There are several other new fires, including the portable "Sol" and "Albion" models. The "Sol" can also be obtained for wall mounting in bathrooms, in which case the adjustment is carried out by means of cords.

Electric Incubators

A new type of electric incubator has been introduced by CURFEW ELECTRIC HEATERS, Brewery Lane, Chertsey. A special feature is a patent removable open-type heater fixed inside the incubating chamber, thus reducing the current consumption. The actual loadings of the elements range from ¾ kW for the 50/60 egg size to 1¾ kW for 200/240 eggs. Control is by a patent sensitive mercury switch consisting of a small mercury tube carried on a pivoted balance operated by the usual capsule and rod, and it is claimed to maintain the temperature constant within ±¼ deg.



One of the new "Curfew" incubators

The hatching chamber is lined with galvanised metal and is deep enough to take pedigree cages, while a nursery is arranged under the hatching drawer. Two water trays are provided. Two-chamber and four-chamber units are available, designed for the accommodation of 300/340 and 600/680 eggs respectively.

A Safe Temperature Indicator for Transformers

The B.E.T. safe temperature indicator, made by the BRITISH ELECTRIC TRANSFORMER CO., LTD., Hayes, is designed specially to indicate the temperature of the hottest oil in a transformer. It consists of a coil which has the same ratio of watts to heat dissipating area as the hottest coil in the main winding. This coil is wound non-inductively and supplied by a current transformer connected in series with the load. The current varies directly with the load, and the heating effect of the coil consequently reproduces the conditions inside the transformer. In the centre of the heating coil the bulb of the thermometer is placed. The current transformer and heating coil are both mounted inside the main transformer, and only the thermometer dial is seen from the outside.

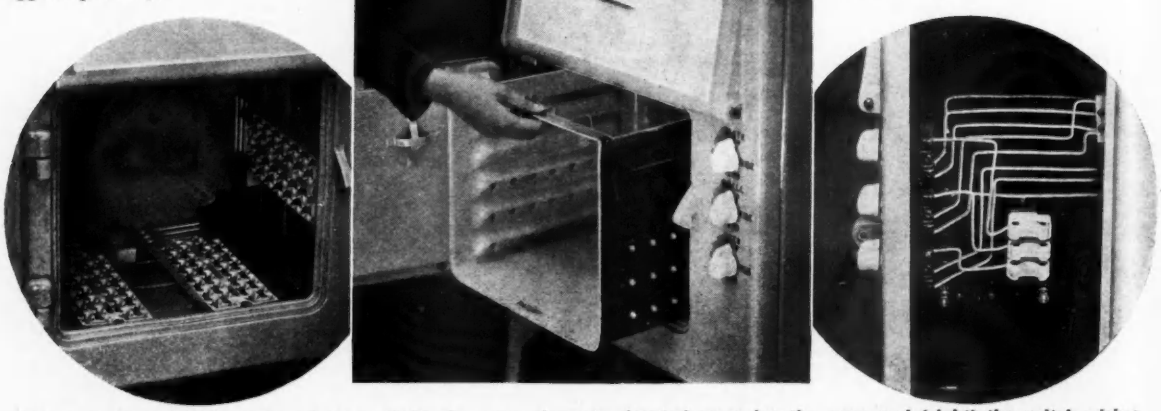
Revo Cooker Improvements

Although, from a cursory glance, the new Revo R.4 cooker does not appear to differ from its predecessors, a closer examination which we made at the London showrooms of the REVO ELECTRIC CO., LTD., Tipton, Staffs, revealed several features of special interest. The hot-cupboard, for instance, has been made from a pressing, thus eliminating all sharp corners and fixing screws and facilitating cleaning. The oven, too, is now much easier to clean, since its interior, made of strong sheet metal, with the rack runners pressed out of the sides, is completely removable along runners and can be washed in a sink. All the edges are rounded

Since the oven interior slides out, the 1,800-W elements are of the open type, situated in the space between the oven proper and the interior lining of the cooker, both at the side and at the bottom. Continuous bus-bar connections between the elements are used, while the switch wiring arrangements at the side of the cooker are also easily accessible by removing a panel held in position by two milled nuts. The switch indications are cast indelibly on the front of the frame, no separate switch panel being provided—in fact, an effort has been made in the design of this cooker to simplify cleaning.

The 8-in. 1,800-W boiling plate and the 2,250-W boiler-griller, measuring 7 in. by 10 in., are of the plug-in type, the plug sockets being fitted just beneath the hob so that they are protected from "spill-overs"; as an extra precaution, the metal surrounding them has been shaped to form a water-shed. The "Superspeed" open-type boiling plate is available as an extra.

The dimensions of the oven are 12½ in. wide by 12½ in. deep by 11 in. high, three heats being provided for the oven, boiling plate and griller individually. Overall dimesions of the cooker are 21½ in. wide by 16¼ in. deep by 35¼ in. high.



The new Revo "R4" cooker showing (left) the oven elements, (centre) removing the oven, and (right) the switch wiring arrangements

Domestic Electrical Appliance Production

A new factory at Dudley

A RECENT visit to the new National Works at Dudley of the Co-operative Wholesale Society, Ltd., for the production of domestic electrical appliances revealed many advantages which result from merging various manufacturing processes with similar processes followed in the production of other equipment for which adequate plant was already in existence. We saw table and floor standards being made and metal and glass pendants in quantities that suggest a well-sustained demand for this class of ware. Indeed, it is largely in connection with the up-to-date brass working methods that the dual manufacture is carried out so efficiently. Again, the great variety of finishes which are so essential in the production of hearth furniture are available for electric lighting fittings and appliances, particularly fires, and a comprehensive and modern plating equipment provides for an almost unlimited variety of finishes, including chromium, nickel, bronze and copper.

Apart from a wide range of electrical labour-saving household appliances, almost every kind of domestic hardware is produced in these works, and as a result of such merging and adaptation of processes the important electrical production scheme is practically self-contained. To quote a few examples: wash-boiler interiors and bodies are produced in the general press shop, while the foundry caters for castings for fires and wash-boiler tops. We saw wash-boiler feet and tops being treated in the pickling vats and galvanising baths, and electric kettles being coated in the large tinning department in which various methods of tinning were being carried out. The spray painting booths and stove enamelling plant lend themselves well to the treatment of fire castings.

In no other case have we seen production which is so essentially laid down to serve the hardware man, responsibility for whose electrical education has been readily accepted by the C.W.S. Electrical Department. A lecture and demonstration room has been established for this purpose and in a well set-out showroom we saw to advantage the many appliances already under production. Another point worthy of mention is that the whole of the junior labour employed was taught during a three months' training course.

In the well-equipped drawing office we saw evidence of the policy which demands that every production job, at any rate on the practical side, should originate on the drawing boards, and this is particularly marked in the neon section which has its own drawing office and showroom. Every neon tube sent out is bent in the shops, and we were able briefly to follow such subsequent processes as washing and drying the tubes, evacuating and filling them with helium gas for "bombardment" by the application of up to 15,000 V for the removal of foreign materials from inside the tube, and the final filling with neon, argon or mercury vapour for red, green or blue lighting. The department makes its own supporting letters or figures in wood and "Staybright" steel, and it is also equipped for producing sign transformers. The neon department is complete with a test room for which is claimed the provision of every known commercial test.

An interesting production shop is that in which lampshades are made from frames constructed to template and covered with material which is cut and perforated by machine. The "Rhodoid" covering is either hand-painted, printed or stencilled according to the design.

Apart from the production and treatment of components in the general shops, most of the work consists of assembly, so that the electrical factory proper is largely equipped with assembly benches and bench machinery. Element spirals, for instance, are made on a mandril winding machine, while mica elements for electric irons are wound on suitable bench frames.

These machines have been designed and built in the works by the electrical staff. It was pleasing to see how far up to the tips of the irons the windings are taken, and also the mica extensions which are carried to the extremity of the sole for protecting the connections. The machine shops in the electrical factory are complete with a modern press plant, and there is also a large hand-press section. All the necessary pressings for use in electric irons, vacuum cleaners and fires are produced on the premises. We also saw a battery of metal spinning lathes for the production of chromium and copper kettles and saucepans.

Sections of the C.W.S. National Works at Dudley

1. A general view of the assembly shop. 2. Boilers ready for testing. 3. The vacuum pumping and filling department in the neon shop. 4. A view of the electric fire assembly benches

"Season cracking" of spun articles has been overcome by dual temperature treatment. An initial high temperature annealing is followed by a low temperature treatment to relieve stresses. A large tinsmith's section is devoted to the manufacture of vacuum cleaner bodies and sheet metal fires.

The testing and inspection section can boast of some very fine equipment. We saw, for example, a bench outfit with the controls and instruments built up in control desk form to serve for 2,000-V flash testing. The engineers have, however, been put on their guard in this connection, for there are also 500-V insulation testing sets (supplied through rectifiers) and it was explained that it is not considered wise to subject mica elements to a pressure under test which might easily be the cause of later breakdown. We saw adequate bench gear for consumption testing of various types of heaters, endurance and water lift testing of vacuum cleaners, and stroboscopic balance testing for vacuum cleaner motors and fans.

Articles are selected from production and subjected to tests under conditions exceeding the most severe that are ever likely to be met in everyday use. We were shown results of heat radiation tests on various types of fire-bars and reflectors. There is also a well-equipped but entirely separate and self-contained repairs department in which many design and manufacturing lessons should be learned as the result of trouble diagnosis.

New Books

Foundations of Short-Wave Therapy. By W. HOLZER and E. WEISSENBERG. (Translated by Justina Wilson and C. Dowse.) Pp. 228; figs. 53. Hutchinson & Co. Price 12s. 6d.

The book is a useful addition to the library of anyone concerned with the production and application of equipment for the treatment of diseases by means of short-wave electrical energy. About three-quarters of the volume is concerned with electro-physics, technique, and constructional details, the remainder being of medical interest. Much useful information is provided on a number of current problems, and the authors have based their conclusions on scientific reasoning rather than upon empirical observations.

The first section is devoted to a simple mathematical treatment of the principles and conditions necessary for the production of h.f. oscillations, and comparison is made between the spark-gap oscillator and the valve machine. This matter is familiar to students of a.c. work and radio engineering. The application of h.f. energy to biological materials by the older method, known as diathermy, where direct conduction occurs between the output electrodes, is compared briefly with the condenser-field method, in which energy is conveyed to the object under treatment through air gaps interposed between it and the electrodes. Series and parallel arrangements of conductors and capacities are outlined, followed by considerations of the electric field and the effects of placing materials having different dielectric constants in it.

The energy concentration which occurs in those parts of the field where pointed or curved objects are introduced and the possibility of errors in measurement consequent upon the introduction of thermo-couples are discussed. The care necessary when introducing the human dielectric is also stressed under this heading, besides being mentioned later in other connections. Results of measurements upon the specific resistances and dielectric constants of biological materials, taken under short-wave conditions, are summed up in suitable tables. The subject of energy absorption is reviewed at some length and supplemented by curves and tables which provide much useful information concerning optimum wavelengths and the conditions necessary for maximum heat production. The dielectric displacement known as polarisation, consequent upon the application of the electric field, receives careful consideration, while the selective or specific action of short waves upon the tissues is debated. The technique of measurement has not been omitted, and the available methods are clearly outlined for all the essential factors. The remainder of the technical section is concerned with practical hints and considerations of the constructional details and requirements of short-wave generators.

Faraday's Diary. (Volume VII, and index). Edited by T. Martin. Pp. 465; illus. London: G. Bell & Sons, Ltd. Price £7 7s. for seven volumes and index.

The production in complete form, admirably printed and illustrated from the original manuscript books, of the philosophical notes that constitute the "Diary" of Michael Faraday, must be counted amongst the triumphs of the Royal Institution. During the last five years, while publication has been in progress, praise has been accorded for the separate volumes of the work as they were published. Welcome has now to be given to the final volume and to the additional index volume that imparts to the whole completeness and co-ordination. This opportunity is taken by Mr. Thomas Martin, under whose editorial supervision the plan of the Managers of the Royal Institution in producing the "Diary" has been carried into effect, to thank his colleagues Mr. A. J. V. Gale, Mr. R. Cory, and Mr. W. J. Green for help in ensuring accuracy in the text. To Sir William Bragg and to the Managers he also acknowledges indebtedness. The eight volumes are in fact an example of literary team-work well done, and reflecting credit upon all who have taken part therein, not forgetting the printers and publishers.

Volume VII is fully as attractive as its predecessors. Among other interesting matter it contains an account of the experiments made in 1853-1854 by Faraday and Latimer Clark on the charge taken up by a telegraph wire covered with gutta-percha when immersed in water, and it describes the apparatus used for these early tests depending upon capacity and dielectric resistance, demonstrating, as Faraday remarked, "a beautiful case of the identity of static and dynamic electricity." Here also is the entry of Faraday's investigations of the phenomena of electric discharge using the vacuum tubes of Gassiot. And, finally, there is appropriately recorded his researches with Steinheil's apparatus for the study of spectra, using an arc between platinum points, and operating with a magnetic field—researches continuing to March 12th, 1862, that is, to "probably the last experiment Faraday ever made."

To students of the literature of physical science it will always be a fruitful occupation to compare the ultimate account left to them by Faraday himself in his "Experimental Researches" with that in this more human "Diary" in which he enshrined his thoughts in their nascent state. He was able to express satisfaction that the different parts of his "Experimental Researches," written at intervals, were found to be in harmony, the reward of accuracy and the evidence of consistency of thought, and it would have pleased him to find that same harmony in his "Diary" as it is now, skilfully and sympathetically edited and indexed.

Electrical Measurements and Measuring Instruments. By E. W. GOLDING, M.Sc.Tech., A.M.I.E.E. Pp. 812; figs. 447. London: Sir Isaac Pitman & Sons, Ltd. Price 20s. net.

This book, which is one of the publishers' "Engineering Degree Series," covers the requirements of the syllabuses of final university examinations in electrical measurements, and its suitability is attested by the early appearance of a second edition. In this the author has incorporated additional material relating to rectifier instruments, photo-electric cells, photometry, and cathode-ray oscillographs. In the theoretical sections the work has been strengthened by a short account of symmetrical components, and by additional matter on ballistic galvanometers and harmonic analysers. A considerable portion of the book is devoted to basic electrical theory considered from the point of view of electrical measurements, while in the remainder of the work, dealing with the technique of measurement, the bias is distinctly on the laboratory side.

We would suggest that in the next edition more detailed attention should be paid to the commercial aspects, as considering the book as a work of reference, it is now somewhat weak on this side. In the section on current transformers there is no reference to the partly direct-reading testing set which is now available for use in meter test houses. The important subject of kVA measurement is somewhat cursorily treated in the chapter on energy measurement. In the section dealing with approximate methods of measuring power in a three-phase circuit by one wattmeter, some standard commercial methods seem to have been ignored. Otherwise the work is excellent. It is copiously illustrated, and each chapter is provided with a full list of references to other works and to original papers.

Small Alternating-Current Motors. By A. H. AVERY. Pp. 51; figs. 26. London: Percival Marshall & Co., Ltd. 1s. 6d.

This is an elementary book on single-phase fractional-h.p. motors. It gives descriptions, brief but adequate for its purpose, of the various types of machine available (though we could not find a mention of the repulsion-induction principle) with particular reference to starting conditions. It should thus facilitate the choice of a motor for any specific duty. A good section is that which furnishes brief particulars of the internal construction of each kind of machine with photographs that give a clear idea of engineering detail. Another section contains calculations, in the simplest terms, for rewinding motors to suit altered voltage, frequency or speed. Magnetic flux is the most theoretical aspect dealt with and this is discussed in plain language, although the meaning of "C.G.S. units" (p. 42) may not be known to many of the readers for whom the work is clearly intended. The book can be recommended to those whose training has been on practical rather than on academic lines, but even the latter may find the survey of interest.

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Shorter Notices

"Electrical Engineering Economics," by D. J. Bolton. Pp. 365; figs. 45. London: Chapman & Hall, Ltd. Price 21s. net.

"Intermediate Engineering Drawing," by A. C. Parkinson. Pp. 170; figs. 302. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d. net.

"Outline Notes on Telephone Transmission Theory," by W. T. Palmer. Pp. 165; figs. 70. Price 4s. London: Sir Isaac Pitman & Sons, Ltd.

United States Electrical Exports

Increased shipments to British Empire countries

THE recently issued annual statement of the export trade of the United States for 1934, showing the countries of destination of all the principal groups of commodities, reveals the direction taken by the recovery which occurred in that year in the electrical trade. The grand total of electrical exports was $66,525,000, or roughly $23,000,000 more than in 1933. It was, however, still considerably below the 1931 total of nearly $84,000,000, while in 1930 the total was $116,000,000.

The following figures show the values of exports of the leading classes of electrical machinery and apparatus in 1934, with the outstanding countries of destination, and notes of increases or decreases as compared with the preceding year are added. Several notable increases in shipments of electrical equipment to British countries as compared with 1933 are recorded, *e.g.*: United Kingdom, from $2,900,000 to $5,335,000; Canada, from $4,700,000 to $7,753,000; India, from $1,464,000 to $1,956,000; Australia, from $1,127,000 to $2,188,000; New Zealand, from $542,000 to $1,070,000; and South Africa, from $2,700,000 to $5,279,000.

	1934. $(000).	Inc. or dec. $(000).
Generators, d.c.—		
Total ...	86	+ 24
To Canada ...	8	+ 5
„ Mexico ...	41	+ 20
„ Hong Kong ...	11	+ 11
Generators, a.c., under 2,000 kVA.—		
Total ...	144	+ 64
To Venezuela ...	17	+ 14
„ Australia ...	16	+ 16
Generators, a.c., 2,000 kVA and over—		
Total ...	267	− 59
To Spain ...	43	− 115
„ Mexico ...	29	+ 15
„ Panama ...	171	+ 171
Steam turbine generator sets—		
Total ...	167	− 579
To Argentina ...	5	− 721
„ Brazil ...	50	+ 50
Accessories and parts for generators—		
Total ...	407	+ 191
To Canada ...	36	− 7
„ Italy ...	67	+ 66
Arc welding sets—		
Total ...	376	+ 213
To Mexico ...	37	+ 6
„ Italy ...	8	− 12
„ Canada ...	58	+ 50
„ Persia ...	42	+ 42
Self-contained lighting outfits—		
Total ...	209	+ 72
To China ...	16	+ 1
„ South Africa ...	30	+ 22
„ United Kingdom ...	19	+ 11
Batteries, 6 and 12 V. storage—		
Total ...	1,102	+ 357
To South Africa ...	126	+ 24
„ Holland ...	82	+ 44
„ India ...	128	+ 58
„ Colombia ...	33	+ 5
„ Chile ...	41	+ 31
Other storage batteries—		
Total ...	487	+ 245
To Mexico ...	42	− 5
„ South Africa ...	92	+ 64
„ Chile ...	82	+ 79
No. 6 dry-cell batteries—		
Total ...	248	+ 12
To Argentina ...	47	+ 13
„ Newfoundland ...	22	+ 3
„ Brazil ...	12	− 2
„ China ...	55	+ 6
Flashlamp batteries—		
Total ...	1,833	+ 281
To Argentina ...	117	+ 15
„ Colombia ...	111	+ 26
„ India ...	479	+ 87
„ Malaya ...	307	+ 134
„ China ...	31	− 138
„ Netherlands East Indies ...	254	+ 26
„ Siam ...	73	+ 15
„ South Africa ...	94	+ 39
Radio B. and C. dry batteries—		
Total ...	247	+ 75
To Argentina ...	103	+ 35
„ China ...	34	+ 8
„ South Africa ...	27	+ 13
Other dry and wet primary batteries—		
Total ...	69	− 1
To Canada ...	16	− 21
„ South Africa ...	13	+ 13
Power transformers, 500 kVA and over—		
Total ...	165	+ 55
To Panama ...	49	+ 49
„ Brazil ...	44	+ 44
Distribution transformers, less than 500 kVA—		
Total ...	345	+ 134
To Mexico ...	83	+ 38
„ Venezuela ...	46	+ 20
Instrument transformers—		
Total ...	77	+ 27
To South Africa ...	17	+ 6
Other transformers—		
Total ...	188	+ 73
To Canada ...	26	+ 11
„ Mexico ...	39	+ 25
„ South Africa ...	14	+ 2
Double current and motor generators, convertors, etc.—		
Total ...	156	− 3
To Holland ...	2	− 27
„ Canada ...	36	+ 16
Switchboard panels, except telephone—		
Total ...	280	+ 143
To Mexico ...	46	+ 11
„ Spain ...	38	+ 36
„ South Africa ...	21	+ 19
Power switches and circuit breakers over 10 A—		
Total ...	522	− 26
To Canada ...	121	+ 55
„ India ...	19	− 206
„ Mexico ...	63	+ 34
„ South Africa ...	92	+ 52
Fuses—		
Total ...	117	+ 33
To Canada ...	13	− 2
„ Mexico ...	19	+ 8

	1934. $(000).	Inc. or dec. $(000).
Watt-hour and other measuring meters—		
Total ...	238	+ 58
To Mexico ...	43	+ 31
„ Argentina ...	40	− 44
Indicating instruments—		
Total ...	441	+ 148
To United Kingdom ...	76	+ 33
„ Italy ...	53	+ 12
„ Canada ...	79	+ 19
Recording instruments—		
Total ...	203	+ 79
To France...	20	− 7
„ Canada ...	26	+ 13
Other testing apparatus—		
Total ...	604	+ 216
To Canada ...	164	+ 36
„ Soviet Russia ...	67	+ 63
„ Japan ...	34	+ 18
Lightning arrestors, choke coils, etc.—		
Total ...	345	+ 35
To Spain ...	42	+ 5
„ India ...	37	+ 8
Motors, ¼ h.p. and under—		
Total ...	532	+ 128
To United Kingdom ...	138	+ 33
„ Argentina ...	37	+ 1
„ Brazil ...	19	− 6
„ Australia ...	43	+ 21
Motors, over ¼ and under 1 h.p.—		
Total ...	184	+ 47
To United Kingdom ...	45	+ 22
„ Argentina ...	13	− 7
„ Australia ...	21	+ 9
Stationary motors, 1–200 h.p.—		
Total ...	852	+ 342
To Canada ...	74	+ 33
„ Mexico ...	175	+ 99
„ South Africa ...	45	+ 24
Stationary motors, over 200 h.p.—		
Total ...	71	− 16
To Venezuela ...	18	− 19
„ Mexico ...	19	− 4
Railway motors—		
Total ...	101	+ 54
To Spain ...	78	+ 46
Elec. locomotives, railway—		
Total (all to Canada) ...	17	+ 17
Elec. locomotives, mining and industrial—		
Total ...	364	+ 169
To Canada ...	44	− 4
„ South Africa ...	70	+ 11
„ India ...	37	+ 20
Electric trucks—		
Total ...	123	+ 88
Starting and controlling equipment for railway and vehicle motors—		
Total ...	142	+ 46
To Spain ...	2	− 15
„ Brazil ...	13	− 5
„ Soviet Russia ...	14	+ 12
Ditto, for industrial motors—		
Total ...	711	+ 308
To Canada ...	232	+ 119
„ Argentina ...	16	− 33
„ Mexico ...	61	+ 16
Portable electric tools—		
Total ...	708	+ 308
To United Kingdom ...	182	+ 80
„ France...	87	− 2
„ Australia ...	48	+ 28
Accessories and parts for motors—		
Total ...	997	+ 321
To Canada ...	257	+ 92
Household refrigerators—		
Total ...	8,180	+ 3,708
To France ...	979	+ 689
„ United Kingdom ...	843	+ 439
„ South Africa ...	1,555	+ 622
„ N. East Indies ...	201	+ 54
„ Argentina ...	145	− 58
„ Brazil ...	642	+ 241
„ India ...	217	+ 66
Commercial refrigerators—		
Total ...	1,917	+ 887
To United Kingdom ...	362	+ 219
„ France...	399	+ 226
Electric fans—		
Total ...	336	+ 166
To Canada ...	52	+ 34
„ Argentina ...	20	− 5
„ United Kingdom ...	67	+ 49
Incandescent lamps for automobiles, flashlamps, etc.—		
Total ...	220	+ 110
To India ...	73	+ 37
„ South Africa ...	23	+ 12
Other metal filament lamps—		
Total ...	669	+ 189
To Chile ...	60	− 2
„ Argentina ...	120	+ 59
Other electric lamps—		
Total ...	83	+ 47
To Canada ...	39	+ 25
Household washing machines—		
Total ...	323	+ 154
To Canada ...	97	+ 49
„ South Africa ...	45	+ 34

	1934. $(000).	Inc. or dec. $(000).
Domestic vacuum cleaners—		
Total ...	230	+ 20
To Canada ...	22	− 52
„ United Kingdom ...	38	+ 35
Flat-irons—		
Total ...	163	+ 72
To Argentina ...	36	+ 4
„ Mexico ...	39	+ 25
Cooking ranges—		
Total ...	250	+ 95
To South Africa ...	130	+ 61
„ Mexico ...	34	+ 5
Electric clocks—		
Total ...	97	+ 19
To Canada ...	29	+ 7
Electric furnaces, etc.—		
Total ...	351	+ 185
X-ray apparatus, etc.—		
Total ...	1,025	+ 368
To Canada ...	288	+ 52
„ Mexico ...	65	+ 8
„ Argentina ...	44	− 1
Radio transmitting sets, tubes and parts—		
Total ...	1,090	+ 347
To Mexico ...	136	+ 19
„ China ...	137	+
„ Canada ...	64	−
„ Colombia ...	174	+ 86
Receiving valves—		
Total ...	3,209	+ 586
To France...	544	+ 33
„ Italy ...	107	− 112
„ Canada ...	147	+ 47
„ Argentina ...	600	+ 102
„ Australia ...	573	+ 197
„ Belgium ...	371	+ 200
Receiving sets—		
Total ...	15,338	+ 6,015
To Belgium ...	278	− 312
„ France...	672	− 58
„ Spain ...	2,100	+ 374
„ United Kingdom ...	1,290	+ 750
„ Mexico ...	1,012	+ 318
„ Argentina ...	211	− 155
„ Brazil ...	1,172	+ 479
„ South Africa ...	1,950	+ 1,200
Receiving set components—		
Total ...	4,359	+ 1,575
To Argentina ...	1,022	+ 303
„ Canada ...	1,112	+ 422
Loudspeakers—		
Total ...	361	+ 23
To Argentina ...	75	− 39
Other receiving set accessories—		
Total ...	498	+ 184
To Argentina ...	34	− 7
„ Australia ...	101	+ 78
„ Canada ...	59	+ 25
Telegraph apparatus—		
Total ...	244	+ 80
To Canada ...	140	+ 90
„ Mexico ...	3	− 32
Telephone instruments—		
Total ...	175	+ 10
To Brazil ...	52	+ 51
Other telephone equipment—		
Total ...	1,044	+ 313
To Canada ...	364	+ 199
„ Japan ...	42	− 58
„ Colombia ...	93	+ 24
„ Brazil ...	77	+ 33
„ China ...	113	+ 80
Starting, lighting and ignition equipment (except spark plugs)—		
Total ...	1,233	+ 399
To Canada ...	217	+ 95
„ Belgium ...	72	− 21
„ Holland ...	90	+ 38
„ Soviet Russia ...	94	+ 14
„ Japan ...	55	− 7
Insulating material—		
Total ...	271	+ 81
Metal conduit and switchboxes—		
Total ...	450	+ 107
To Brazil ...	60	+ 14
„ Colombia ...	34	+ 4
„ Argentina ...	14	− 16
„ Mexico ...	79	+ 19
Lighting switches, sockets, etc.—		
Total ...	888	+ 363
To Mexico ...	65	− 25
„ Canada ...	157	+ 33
„ United Kingdom ...	262	+ 140
Insulated iron or steel wire and cable—		
Total ...	24	+ 17
Rubber-covered copper wire—		
Total ...	642	+ 210
Telephone cable—		
Total ...	35	+ 11
Insulated copper weatherproof wire—		
Total ...	236	+ 86
Other insulated copper wire—		
Total ...	751	+ 259
Nickel-chrome elec. resistance wire—		
Total ...	373	+ 88

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

An Airport Equipment Exhibition

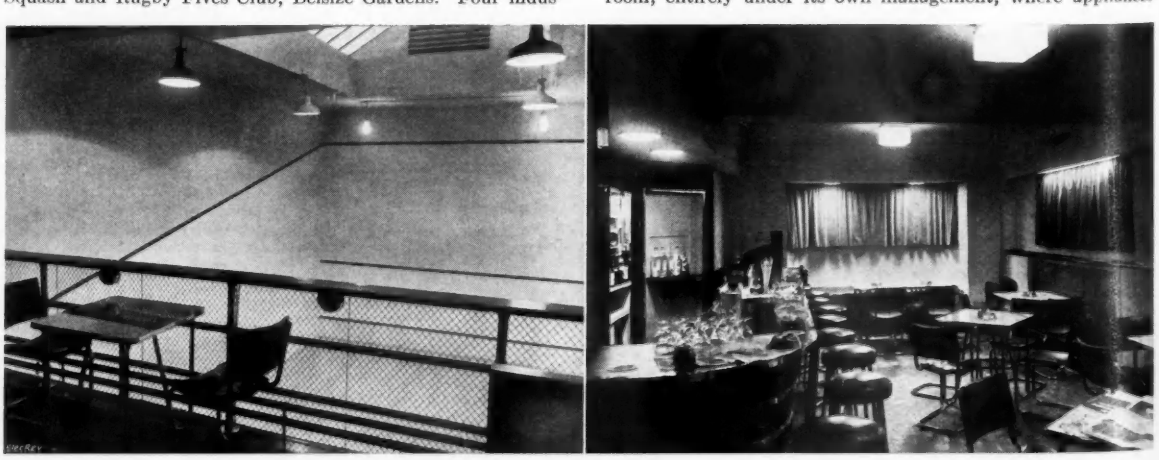
The extremely large part that electricity plays, not only in the construction of aircraft itself, but also in the numerous devices now available to ensure maximum safety at airports and landing grounds is not yet generally realised. Last week at an exhibition of aerodrome equipment supplies and services held at British Industries House, Marble Arch, London, and arranged by the Society of British Aircraft Constructors for the Aerodrome Owners' Association, a considerable number of the seventy firms exhibiting were manufacturers of electrical equipment. A large demand for cables and flexibles for airplanes was reported by Callender's Cable and Construction Co., Ltd., among whose exhibits were specimens of cables specially designed for use on landing grounds. Included among numerous boundary beacons were a model made by Messrs. Chance Bros. & Co., Ltd., having a spare bulb which lights automatically if the other fails, and the Cardiff Foundry & Engineering Co.'s " Pillar of Fire " model which, should an airplane hit it, switches off automatically without danger of fire and is claimed to cause no damage to the airplane. Aerodrome lighting equipment was also shown by Messrs. Benjamin Electric, Ltd., Chance Bros. & Co., Ltd., and Clarke, Chapman & Co., Ltd. Radio apparatus was well represented by Marconi's Wireless Telegraph Co., Ltd.; Standard Telephones & Cables, Ltd.; Radio Transmission Equipment, Ltd.; and Gambrells, Rowse & Snoaden, Ltd. A " Keepalite " emergency lighting system shown by the Chloride Electrical Storage Co., Ltd., is designed to provide 1½ kW for one hour. Among other electrical exhibitors were Messrs. Desoutter Bros., Ltd. (electric tools), G. N. Haden & Co., Ltd. (photographs of recent installations), N.S. Accumulators, Ltd., Troughton & Young, Ltd., and Tecalemit, Ltd.

New Dundee Showrooms

A showroom for Dundee Corporation Electricity Department at 95, Commercial Street was formally opened on January 30th by Mrs. Ames, wife of Councillor W. M. Ames, convener of the Electricity Committee. Among those present were Lord Provost Phin, Dundee, and the Lady Provost; Mr. D. H. Bishop, electrical engineer and manager; Mr. J. A. Bell, electrical engineer, Aberdeen; and Mr. E. M. Hood, Glasgow, area officer of the British Electrical Development Association. Councillor Ames said a scheme of wiring on the hire-purchase system was being offered to those who preferred to pay by instalments. Cookers and other heavy apparatus would also be supplied under a similar scheme. There would be an alternative simple hiring system.

Squash Court Illumination

Modern illumination of both the utilitarian and decorative varieties is to be seen in the electrical installation just completed by Messrs. S. Rogers & Co., Ltd., at the Hampstead Squash and Rugby Fives Club, Belsize Gardens. Four industrial type fittings are sufficient to provide adequate lighting for each court, while for the lounge and cocktail bar, in addition to totally enclosed rectangular ceiling fittings manufactured by Ascog, Ltd., the electrical contractors have themselves constructed a number of flush units for use over the bar and above the windows. Other fittings were supplied by Messrs. Dernier & Hamlyn, Ltd.



A court (from the spectators' gallery), and (right) the lounge and cocktail bar at the Hampstead Squash and Rugby Fives Club

Advertising the Engineering Product

A paper on " Advertising as a Factor in Marketing the Engineering Product," was read by Mr. J. H. Beaumont Robins on January 15th before the Belfast Association of Engineers. Mr. Robins dealt with the practice of advertising in relation to industry and some causes contributing to its growth, engineering advertising in particular.

The Contractors' Dinner

The annual dinner of the Electrical Contractors' Association which was to have been held on February 28th, but was postponed, is to take place on March 17th at the Savoy Hotel, London, W.C.2.

An " All-in " Automatic Cooker Scheme

It is of interest to learn, in view of the article on " Automatic Cooker Control " on page 195 of this issue, that the Lancashire Electric Power Co. has introduced a scheme for the hiring-out of a controlled cooker. For a sum of 2s. a week the company is providing a cooker suitable for 4-6 persons, a high-speed electric kettle, a good-quality aluminium saucepan, and 45 ft. of wiring, as well as 300 kWh of electricity per quarter. The consumer is bound only for one year, and during the life of the cooker prompt service and maintenance are provided. The automatic control dial is graduated in degrees Fahrenheit, there being five temperature steps—200, 300, 400, 500, and 550 deg.

Erith Electrical Exhibition

Mr. J. C. Williams, A.M.I.E.E., electrical engineer to the Erith Urban District Council, informs us that it is proposed to hold an electrical exhibition in Erith from March 23rd to April 4th. Accommodation adjacent to the Council Offices is being adapted for the purpose, and every effort is being made by means of publicity, entertainments, lectures, &c., to render the exhibition a success. The exhibition will cover the general domestic uses of electricity and such industrial uses as are particularly applicable to the Erith district.

Domestic Appliances in Belgium

Belgian trade in electrical household appliances is the subject of a report made in December by Mr. H. Turcot, the Canadian Trade Commissioner in Brussels. No fewer than 2,620 communes out of 2,670 in Belgium are supplied with electricity, largely at 110 V d.c. and 220 V a.c., with a tendency to adopt the latter and to abandon d.c. whenever possible. The average price of electricity for lighting and other household uses is 4d. per kWh. The prospects for the sale of imported appliances are not uniformly good because of keen competition from a number of different countries. Another obstacle to a newcomer in the market is the close relationship which exists between the electricity supply companies and the manufacturers, combined with arrangements for letting consumers have appliances on easy terms or at cost price. An interesting experiment has been started at Schaerbeek, near Brussels. The municipality has opened a well-appointed showroom, entirely under its own management, where appliances are displayed, both of Belgian manufacture and foreign, which have been lent by manufacturers on a sale-or-return basis, the profits to be shared between the municipality and registered electricians residing therein. Judging from the number of firms engaged in selling vacuum cleaners in Belgium, and from the unceasing activity displayed by all of them, it seems to Mr. Turcot that saturation point must shortly be reached. But he adds that despite the very keen competition it is believed that there is a large potential market for a low-priced robust vacuum cleaner, equipped with a universal motor. With regard to refrigerators Mr. Turcot comes to somewhat similar conclusions. A small low-priced kitchen refrigerator, it is

thought, might meet with success. In addition refrigerating chambers for butchers' shops and similar establishments appear to offer a possible outlet. The chambers themselves are constructed in Belgium from local material, while the refrigerating apparatus is imported. For the sale of electric cookers, water heaters and toasters prospects are not good. Electric irons are becoming increasingly popular but Germany seems to be the only country in a position to meet the domestic competition. Nor is there any promise of increased sales of imported electric washers and radiators.

Power for Gold Mines

Presiding at the annual meeting of the Ashanti Goldfields Corporation, Ltd., held on January 30th, Mr. J. H. Batty (chairman), in the course of his speech, said that during the current year they were carrying out a large power construction programme and adding a new a.c. power station with two 1,000-h.p. gas-electric sets and one 50-kW motor-alternator; also two new 2,000 cu. ft. Belliss compressors. They had to look well forward and to see that they had sufficient power for the increased demand due to the extensive development work at the outlying properties, not only in the immediate future, but for some years ahead.

Smoke Prevention in the Potteries

The Gas and Electricity Committees of the Stoke-on-Trent City Council are considering separate schemes to minimise smoke pollution caused by potteries. According to the *Manchester Guardian*, the Electricity Committee on January 30th submitted a proposal that £110 should be paid to Major Bernard Moore, a consultant potter, towards the rent and rates for a year of a special building to be acquired for experimental work in the use of electricity for the firing of kilns containing pottery ware, and that he should be provided with free electrical energy and switchgear. The Council referred the proposal back for further consideration.

Orders Recently Booked

Among orders which British Insulated Cables, Ltd., has in hand are forty-four power-factor condensers for a Birmingham factory, two 220-kVA, h.v. power-factor condensers for a Durham colliery, twenty tons of aluminium strip for a Yorkshire metal works, and seven tons of commutator copper for one of the main railway companies. Orders for "Rockbestos" brand products include 20,000 yds. of a special acid-resisting flexible for an artificial silk company, 5,000 yds. of arc light and projector cable for Australia, and 8,000 yds. of switchboard wire for South Africa. An important road haulage concern has adopted B.I. flexible with "Thiokol" brand sheathing for use with hand lamps in its garages.

The sales of International Combustion, Ltd., during January included ash-handling plant for Dalmarnock power station (through Yarrow & Co., Ltd.), and an "L" stoker for the English Steel Corporation (through the Stirling Boiler Co., Ltd.).

A New E.C.A. Branch

The leading electrical contracting firms in the Colchester district have formed a branch of the Electrical Contractors' Association.

Economical Showroom Lighting

By the use of specially designed fittings requiring fewer or less powerful lamps, G.V.D. Illuminators, Ltd., claim to effect economies amounting in certain instances to as much as 75 per cent. of the normal lamp and energy costs. On account of their providing a practically glareless and shadowless illumination the company's box-type totally-enclosed ceiling fittings are

Well-diffused lighting at the showrooms of Car Mart, Ltd.

particularly suitable for showroom lighting, and our illustration shows a recent installation carried out out at the Car Mart, Ltd., Finchley Road, London, N.W.11. The units used here are of chromium plate with panels of fluted glass, the underside being of peach-tinted plate mirror, and the light is so diffused that it is possible to see easily, not only inside the cars exhibited, but also underneath.

A Battery Charger Sales Campaign

Messrs. Partridge, Wilson & Co., Ltd., have launched a sales campaign for their "Davenset" car battery auto-charger. An attractive three-colour folder describing the auto-charger is being circulated, coupled with trade and national Press advertising. An effective cut-out window display has also been prepared.

B.I. Sheffield Showroom

Continuing the policy of holding periodical displays of its manufactures in important centres, which has proved so successful in London, Glasgow, Newcastle and Birmingham, British Insulated Cables, Ltd., has now equipped a showroom at 17, Castle Street, Sheffield, in which is displayed a representative range of manufactures, with photographs of the

The new showroom of British Insulated Cables, Ltd., at Sheffield

company's works and outside activities. As in previous displays there are electric welding demonstrations, several of the latest B.I. electric welders being installed.

Irish Free State Electrical Imports

There was a quieter tone in the electrical trade in the Irish Free State during December last, the imports of electrical machinery and cognate material attaining a value during the month of £85,856 as compared with £97,823 in December, 1934. The appended table shows the imports during last year as compared with those during 1934:—

	1934.	1935.
	£	£
Electric motors	44,908	46,327
Other electrical machinery	277,782	199,869
Dry batteries and parts	31,360	31,761
Electric lamp bulbs	63,671	70,626
Elec. lighting accessories, fittings and parts	52,688	78,911
Electric wires and cables, insulated	86,207	85,165
Telegraph and telephone apparatus	10,835	35,075
Radio receivers, complete	110,785	126,917
Radio-gramophones, complete	7,866	5,898
Other radio apparatus, fully or partly assembled	11,651	6,693
Radio parts and accessories	95,253	90,939
Other electrical goods and apparatus	211,711	268,424
Totals	£1,004,717	£1,046,605

As will be seen, five of the scheduled items show a decrease, this being, however, more than offset by the increase in the remaining seven, the aggregate imports showing an advance of £41,888.

Whitley Council Secretaries Meeting

The Employers' Secretaries of the District Councils and Boards held their first meeting under the auspices of the employers' organisations of the National Council and Board at Nottingham on January 24th, and at the conclusion of the meeting were entertained at luncheon by the Lord Mayor (Sir Isaac Ball), the Sheriff (Councillor S. Mitchell), and the Nottingham Electricity Committee. Mr. G. G. Heathcock (Birmingham) proposed "The City of Nottingham," to which the Lord Mayor and the Sheriff replied. Alderman E. Huntsman proposed a toast to the district secretaries and wished them success in their endeavours to improve the efficiency of the organisations. The National and District Councils and Boards settled matters of policy, and it remained for the secretaries to see that the administrative business was carried out successfully. Mr. A. H. Banks, the first chairman of the secretaries, who replied, said that the task of the secretaries was to lighten the burden of the members by improved efficiency, and if they could do that their object would be achieved. After lunch Alderman Huntsman, accompanied by Mr. W. H. Gilkes, vice-chairman of the No. 7 District Council, conducted the district secretaries upon a tour of inspection of the Council House, Wollaton Hall, and finally the University, where tea was provided.

The Batti-Wallahs' Society

The next luncheon of the Batti-Wallahs' Society will be held on February 27th at the Hotel Metropole, W.C., when

the speaker will be Mr. R. J. Minney. The annual dinner and dance of the Society will be held on March 20th at the Hotel Metropole.

Machine Tool Works Lighting

An interesting installation of B.T.H. industrial lighting equipment employing "Mazda Mercra" lamps has recently been completed for Messrs. Alfred Herbert, Ltd., of Coventry. This equipment provides the whole of the lighting for the recently extended machine shop, including the replacement of existing fittings and lamps in four of the original main bays. The total floor space lighted is 66,000 sq. ft., and adequate and even illumination is provided over the entire area. The bays are illuminated by a total of eighty indoor dispersive type industrial fittings, utilising sixty-two 400-W, nine 250-W "Mazda Mercra," together with nine 500-W "Mazda" and opal lamps. The control gear for each lamp, consisting of a B.T.H. choke, capacitance and double pole switch-fuse, is mounted in every case on a small platform and fixed to a roof truss adjacent to the lighting unit which it controls. In the section of this bay, in which overhead shafting is employed, the lighting is carried out by a mixed scheme of electric discharge and gasfilled lamps. In the remaining section four 400-W "Mazda Mercra" lamps are used, each being housed in the same type of fitting as the other section. The installation was carried out by Messrs. Alfred Herbert's own electrical staff and planned by the B.T.H. Co.'s illuminating engineers.

One of the machine shop bays at the Coventry works of Messrs. Alfred Herbert, Ltd., lighted by "Mazda Mercra" lamps

Association of Ex-Siemens' Men

A smoking concert is to be held at Gatti's Restaurant, King William Street, Strand, W.C.2, on March 13th. Mr. P. C. Pope, 53, Victoria Street, S.W.1, the treasurer, or Mr. R. R. Griffin, c/o the Union Cable Co., Ltd., Dagenham Dock, Essex, the secretary, will be pleased to send particulars of the Association to any qualified for membership.

Benjamin Electric Progress

Since the company's establishment in 1908 the history of Messrs. Benjamin Electric, Ltd., one of the pioneers of scientific industrial lighting, has been one of continuous expansion. The original factory at Tottenham together with the considerable extensions carried out in 1927 are now used purely for what may be called complementary work to the main production now undertaken in a large new factory on the opposite side of Tariff Road. Here all the chief mechanical manufacturing operations are dealt with, from the design and production of machine and press tools to the final inspection of the finished product. Although the company is still principally concerned with the manufacture of industrial lighting fittings, we were impressed during a tour of the factory on Tuesday by the extent of the other work now undertaken. The Benjamin electric water heaters and the "Magnavox" loud speakers are, of course, well known, while the production of vitreous-enamelled pressings for all classes of work, both electrical and non-electrical, is a side of the company's activities which is growing daily. The company has an efficient lighting engineering service, which undertakes surveys and provides specifications, as well as trial installations, for all classes of building.

Inspection department at the works of Messrs. Benjamin Electric, Ltd.

Lamp Publicity

Britannia Electric Lamp Works (1934), Ltd., has issued new advertising material. The principal display piece is a cut-out for shop windows. It is coloured blue and silver, and draws attention to the company's clear and pearl gasfilled lamps with the slogan, "Be kind to your eyes." There is also a window strip with similar wording and a smaller cut-out advertising the company's "Night-a-Light" lamps.

Electric Vehicles for a Dairy

During recent months there has been a very marked increase in the demand for electric vehicles for short distance delivery service, and the Derby Co-operative Society, Ltd., has just ordered the ninety-sixth from A. E. Morrison & Sons, Ltd. This type of vehicle is now distributed in the south of England by the Corporation of Electric Transport, Ltd., which informs us that its biggest supporters, apart from dairies, are bakers, municipal authorities, electricity supply undertakings, laundries and coal merchants, and that many repeat orders are being received.

Prices of Materials

Messrs. Henry Gardner & Co., Ltd., report, February 5th: No change in the price of copper bars (best selected), sheet and rod. English pig lead, £17 10s., 10s. decrease. Spelter, £14 8s. 9d., 12s. 6d. decrease. English block tin, £204, £3 increase.

Messrs. Edward Till & Co. report, February 5th: India rubber, Para fine, 7¼d., ¼d. increase.

Trade Announcements

The Belfast branch of Messrs. W. T. Henley's Telegraph Works Co., Ltd., has been removed to 19, College Street, Belfast (telephone: Belfast 25798).

The Fischer Bearing Co., which is associated with the German concern of the same name, has acquired approximately one-third of the former "Sunbeam Works" from Mr. F. H. Farrer, of the Villiers Engineering Co., Wolverhampton, the present owner. It is expected that work will start immediately in equipping the factory for the manufacture of all kinds of precision steel balls and bearings, and that within twelve months 500 workpeople will be employed.

For Sale

Brighton Corporation electricity undertaking has for sale one d.c. feeder booster set.

(See our classified advertisements.)

New Catalogues and Lists

Simplex Electric Co., Ltd., 159, Great Charles Street, Birmingham, 3.—A catalogue of watertight lighting equipment.

Gent & Co., Ltd., Faraday Works, Leicester.—A publication dealing with a system of luminous signals for use in hotels, ships, offices, &c.

Higgs Motors, Ltd., Witton, Birmingham, 6.—A number of additions to the company's catalogue dealing with motors of various kinds, dynamos, motors and generators, gear units, &c.

Cambridge Instrument Co., Ltd., 45, Grosvenor Place, London, S.W.1.—A brochure illustrating installations of automatic regulators controlling furnaces.

J. A. Brook, Ltd., Lord Street, Huddersfield.—A leaflet dealing with various types of lamp locks.

General Resistors, Ltd., 287, Ilkeston Road, Nottingham.—A catalogue of spirals and elements.

Brown Bros., Ltd., Great Eastern Street, London, E.C.2.—Details of the company's lighting engineering service.

Metropolitan-Vickers Electrical Co., Ltd., 1, Kingsway, London, W.C.2.—A pocket price list of a.c. and d.c. electric motors and control gear.

Erskine, Heap & Co., Ltd., Caroline Street, Salford, Manchester, 7.—A pamphlet giving particulars of a new loom switch.

Herbert Terry & Sons, Ltd., Redditch.—A complete catalogue

(pp. 80) of the company's products, including springs, wirework, &c.

Poles, Ltd., 3, London Wall Avenue, London, E.C.2.—A 96-page illustrated catalogue of "Adastra" sectional steel poles.

Sun Electrical Co., Ltd., 118, Charing Cross Road, London, W.C.2.—Telephones and electric pumps and pumping plant are the subjects of two recently issued booklets.

Bankruptcy Proceedings

A. P. W. Hadley (trading as Express Electrical Supplies), late of 12, Percy Street, W.—This debtor attended on January 30th at the London Bankruptcy Court for public examination upon accounts showing total liabilities of £2,809 (ranking £1,119) and assets £3. The debtor stated that in 1932 he secured an agency for electric lamps on a commission basis which he conducted from his home address. Later he gave up his employment and in 1933 opened an office at Berners Street, W., employed two travellers and traded as a wholesaler in electrical goods and wireless sets under his own name. Having lost his agency for electric lamps in February, 1934, he, in March, 1934, gave up the premises, and thereafter secured another agency for lamps which proved to be unprofitable and was abandoned in 1934. He then took premises at Percy Street and traded there under the name of "Express Electrical Supplies Co.," wholesale electrical and radio dealers. In February, 1935, his supplies of lamps were cut off. In March last judgment was obtained against him for £100 and costs, which formed the basis of these proceedings. In March, 1935, he formed Express Electrical (Hampton), Ltd., with a nominal capital of £500 in £1 shares, and sold all his assets to the company for a sum of £300, which had never been paid to him. He and his wife were appointed directors and he was entitled to £5 per week which was in arrears to the extent of £30. In June last he resigned, since when he had been employed as a traveller at Exeter. The debtor attributed his insolvency to loss of a valuable agency, loss of his trading agreement with the E.L.M.A., insufficient net profits to cover drawings, failure to obtain the purchase price for his assets and his salary, and to depreciation of property. The examination was concluded.

J. R. Mills, radio dealer, &c., 111, Cromwell Road, Muswell Hill, N.—The first meeting of creditors was held on January 29th at London Bankruptcy Buildings before Mr. S. W. Hood, Official Receiver. The debtor states that he began the above business last April with £35 capital and that his failure was caused by his being called upon to repay a loan of £100 which he guaranteed for a friend. The liabilities were returned at £267 and the assets at £7, which is absorbed in a preferential claim. The case remained in the hands of the Official Receiver.

D. S. Williams, 342, Dewsbury Road, Leeds, formerly 90, Churwell Ring Road, Leeds, and lately 40, Granny Avenue, Churwell, Leeds, electrical engineer and contractor.—This debtor filed his own petition, and he has returned a statement of affairs which shows gross liabilities of £789, of which £759 is expected to rank for dividend, with net assets of £244, and a deficiency of £515. He attributes his failure to lack of capital.

E. V. Russell (the Skegness Electric Service), 2, Tennyson Buildings, Drummond Road, Skegness.—Application for discharge to be heard on March 12th at the Municipal Buildings, Boston.

R. Mason, radio and electrical engineer, Crown Square, Kirbymoorside, Yorks.—Last day for receiving proofs for dividend February 12th. Trustee, Mr. C. L. Townsend, 80, High Street, Stockton-on-Tees, Official Receiver.

N. A. Peters, electrical and wireless engineer, 192, Robin Hood Lane, Hall Green, Birmingham.—Receiving order made January 27th on debtor's own petition.

W. F. Welford, electrical engineer, "Roseberry," Alexandra Road, Shanklin, I. of W.—Receiving order made January 29th on a creditor's petition.

H. Vernon, electrical contractor, 105, Palatine Road, Northenden, Manchester.—Receiving order made January 29th on debtor's own petition.

Company Liquidations

Miller & Co. (Radio), Ltd. (trading as Odeon Radio), Odeon Buildings, Northolt Road, South Harrow.—The accounts lodged under the compulsory liquidation of this company show liabilities of £1,552, assets of £817, an issued capital of £913, and a total deficiency of £1,365. The Official Receiver reports that the company was formed in January, 1934, to acquire the business of radio dealers formerly carried on under the style of Odeon Radio. It took over the liabilities and assets and allotted £500 in shares to the vendors as consideration for the business and goodwill. Branches were opened at East Ham and Colindale. The failure of the company is attributed by Messrs. W. Miller and A. Rossall (the promoters) to inability to obtain sufficient capital to provide for a rapidly expanding business and overhead expenses being too high. In the opinion of the Official Receiver the failure is directly attributable to mismanagement in that the promoters permitted the company to commence business without making any proper provision for adequate working capital, and no proper records and accounts were kept. Mr. C. Latham has been appointed liquidator, with a committee of inspection.

Gill & Reigate, Ltd.—Particulars of claims by March 14th to the liquidator, Mr. N. E. Munns, Salisbury House, London Wall, E.C.

Highway Appliances, Ltd.—Particulars of claims by February 29th to the liquidator, Mr. J. J. Ure, 11a, Hart Street, W.C.1.

Whitaker Electric Co., Ltd.—Winding up voluntarily. Liquidator, Mr. H. Rule, Bush Lane House, Bush Lane, Cannon Street, London, E.C.4.

Fylde Radio, Ltd.—Winding up voluntarily. Liquidator, Mr. J. W. Westhead, 12, Birley Street, Blackpool.

Reeser Radio, Ltd.—Winding up voluntarily. Liquidator, Mr. H. J. Box, Liverpool Chambers, Worthing.

Marathon, Ltd.—Meeting March 3rd at the offices of Messrs. Everett, Morgan & Grundy, Bush Lane House, Bush Lane, Cannon Street, E.C., to receive an account of the winding-up by the liquidator, Mr. J. M. Davies.

Liscard Battery Co., Ltd.—Meeting March 11th at the Common Hall, Hackins Hey, Dale Street, Liverpool, to receive an account of the winding-up by the liquidator, Mr. M. L. Hyam.

Private Arrangement

M. Behrman, 3, Burdon Road and 48, Ettrick Grove, Sunderland, wireless dealer, &c.—The creditors met recently at South Shields when the statement of affairs showed ranking liabilities of £2,001. The assets totalled £914, leaving a deficiency of £1,087. It was decided that a deed of assignment should be executed to Mr. A. L. Friends, South Shields, subject to a cash claim being withdrawn and arrangements made for repayment of the bank overdraft.

Economical Air Conditioning

AN inexpensive air-conditioning system has just been completed by the British Electrical Installations Co. at the dressmaking factory of Messrs. Duncan Hutchins, Shoe Lane, London, E.C.4. The system is confined to air warming and ventilating; humidity correction, washing and cooling being omitted on the grounds of cost.

One of the workrooms of Messrs. Duncan Hutchins's dress factory showing the trunking for the heating and ventilation. Inset: A bank of elements inside the trunking

The air, after being filtered, is forced by a Matthews & Yates paddle-blade fan running at 880 r.p.m. through galvanised sheet-metal trunking to the four floors of the building. On entering each workroom the air is passed over a bank of ten 1-kW elements, which are of a novel spiral-wound type, it being possible to lift out a whole bank by simply removing a side section of the trunking. The wiring is carried inside the trunking, out of sight.

Provision is made for four changes of air an hour, and the warmed air is extracted from the workrooms by the same fan and recirculated. In summer the air is drawn solely from outside. The volume of air supplied to each floor is controlled by adjustable vanes, and small adjustable flaps are provided at equal distances throughout the runs in the workrooms to ensure equal distribution throughout. About 300 ft. of trunking has been used in the building, which has a capacity of about 50,000 cu. ft.

The temperature on each floor is separately controlled by McLaren thermostats, which, since the supply is d.c., are made to operate Bray contactors. The heating is separately controlled on each floor by an M.K. switch fuse embodying a pilot light. Advantage is taken of the cheaper electricity rate before 10.30 a.m., and a throw-over time switch is used for this purpose. The whole installation is controlled by time-switch set to operate half an hour before the employés arrive and depart. The heating side is so arranged that should the fan for any reason fail to operate the heating is automatically cut off.

The principal advantages of this system are that pure fresh air is delivered into the workrooms, and in winter is warmed to a desired temperature; outside noise and dust from open windows are eliminated; only that quantity of current required for a given temperature is expended, which means that on many mild days little or no electricity is used; labour cost of running and maintaining it is said to be practically negligible. The total loading of the installation is about 40 kW.

Electricity Supply

Lighting, Domestic, Power

Aberdeen.—NEW PLANT FOR POWER STATION.—A recommendation of the Electricity Committee provides for the extension of the plant at the generating station at a cost of £107,173. Mr. Bell, the electrical engineer, proposes that the two low pressure 1,000 kW steam sets shall be replaced by a new high pressure turbo-alternator of 25,000-kW capacity costing £80,000.

Australia.—NEW MELBOURNE MAIN SUB-STATION.—As the sub-station of the Victorian Electricity Commission in Spencer Street is now loaded to its full capacity, the City Council has arranged to construct a new main sub-station at Waratah Place to take a bulk supply from the Commission at 22 kV. Part of this supply will be transformed to 6.6 kV for distribution and the remainder transmitted by the Council to the Bouverie Street sub-station, which is to be extended. Four 10,000-kVA, 22/6.6-kV, three-phase transformers are being purchased. These are to have auto tap-changing equipment and will be either self-cooling up to full load or air-blast cooled from 70 per cent. to full load.

ADELAIDE PROGRESS.—During the year ended August 31st last the Adelaide Electric Supply Co., Ltd., which has statutory powers covering an area of 3,314 square miles, with a population of 325,000, sold 86.8 million kWh, as compared with 74.2 million kWh in the previous year, an improvement of 17 per cent. The number of consumers increased from 85,753 to 88,407, and the connected load from 174,959 to 198,167 kW. Tariff reductions amounting to approximately £53,000 per annum were introduced on January 1st, 1934, and further concessions (£30,000) on January 1st, 1935.

Bexhill-on-Sea.—LOANS.—The Corporation has applied for sanction to loans of £3,295 for reinforcing the l.v. network, and £30,000 in connection with the change-over.

Brierley Hill.—SODIUM LIGHTING STIPULATED.—Provided sodium electric-discharge lamps are used the Urban District Council has decided to renew the public lighting contract with the Midland Electric Corporation for Power Distribution, Ltd., for a period of five years.

Burnley.—LOWER CHARGES.—The flat rate for lighting is to be reduced to 4¼d. per kWh inside the borough, and 4½d. outside. The fixed rateable value charge in the borough will be 12½ per cent. on the first £15 of rateable value, 10 per cent. on the next £10, and 7½ per cent. on the next £5. Five per cent. is charged above £30. Outside the borough the charge will be slightly more.

The beauty of the Johore Bahru Mosque, Singapore, is enhanced by floodlighting. The installation comprises twelve G.E.C. projectors using 1,000-W lamps

Colwyn Bay.—SUB-STATION CHANGES HANDS.—The Lighting Committee is to purchase the North Wales Power Company's sub-station situated at Dinarth Hall, together with the necessary equipment, in connection with the supply to Glanwydden.

Doncaster.—ELECTRICITY FOR EDLINGTON.—The Doncaster Collieries Association intends to wire for electricity a number of houses at Edlington; if the scheme is a success it will be applied to all houses in the parish which are not yet receiving a supply.

Edinburgh.—STREET LIGHTING.—A programme of street lighting improvements involving the expenditure of over £50,000 has been approved by the Streets and Buildings Committee.

Hawarden (Cheshire).—CONTINUED EXPANSION OF UNDERTAKING.—Mr. A. J. Richardson, the electrical engineer to the Rural District Council, has reported that there are now 4,637 consumers. Householders at Pontblyddyn, who are outside the fringe order area, have applied for a supply, and the electrical engineer is to report to the Council whether it would be a paying proposition.

Horsham.—LOWER CHARGES.—The Urban District Council has reduced the flat rate from 5½d. to 5d. per kWh in the urban area; in the rural area the kVA charge will remain as at present, but the "unit" charge will be 1d. instead of 2d. for the first 1,000 kWh and 1½d. beyond.

Hull.—VALUE OF INDUSTRIAL DEVELOPMENT.—A statement prepared by the Electricity Department shows the consumption of electricity by the newly established firms which the Development Committee has been instrumental in introducing to the city. The increased revenue to date by this means amounts to £8,756, while the value of the present estimated annual consumption is £3,689.

ENLARGING THE POWER STATION.—The Electricity Committee has obtained consent from the Central Electricity Board to extend the Sculcoates power station by the installation of two boiler units having an evaporative capacity of 150,000 lb. of steam per hour, complete with the necessary ancillary plant, to be in commercial operation by September, 1937, and September, 1938, respectively; two 2,000,000-gal. per hour pumps, together with alterations and additions to the existing circulating water system, to be completed by the summer of 1937; and a turbo-alternator set having a maximum continuous rating of 30,000 kW. with auxiliaries, to be in commercial operation by September, 1938.

In the Central Park, Moscow, there are six skating rinks joined by "speedways," and to prevent accidents electric traffic signals have been installed.

REDUCED RENTALS.—The Electricity Department's quarterly hire charges are to be modified in certain cases as follows (existing rates in parentheses): Medium-size cookers, 5s. 6d. (6s.); large cookers, 6s. 6d. (7s. 6d.), exclusive of wiring; 1½-gal. water heaters, scheme 2, 2s. 6d. (3s. 6d.), wiring 1s. (1s. 6d.); immersion heaters, scheme 3, 5s. (6s.), exclusive of wiring; wash-boilers, scheme 4, 2s. (2s. 6d.), exclusive of wiring.

Lancaster.—ORDER FOR RURAL DEVELOPMENT.—The Electricity Committee is seeking an Order for the development of the electricity services in the parishes of Forton, Cleveley, Holleth and Nether at a cost of £15,044.

EXTENSION OF SUPPLY.—The electrical engineer recently submitted proposals for the extension of the electricity supply from Glasson Dock to Cockerham, Ellel and Dolphinholme to complete the existing scheme in the southern area, at an estimated cost of £15,385 for h.v. and l.v. pressure cables, sub-station sites and plant. The Town Council approved the scheme.

Manchester.—NEW FEEDER.—In order to safeguard the electricity supply to Droylsden and Denton West the Electricity Committee is seeking powers to borrow £15,000 for a new 33,000-V feeder between Stuart Street and Droylsden and an additional £4,000 for switch units.

Morecambe.—SUB-STATIONS.—Further sub-stations are to be provided and equipped at a cost of £16,264 during the next three years.

FEEDER CABLES.—The Electricity Committee is to extend h.v. feeder cables at a cost of £7,000.

Newark.—REVISED TERMS.—The Electricity Committee has recently considered an offer of the Derbyshire and Nottinghamshire Electric Power Company for revised terms to operate, as from April last, for a period of ten years. It was decided to recommend acceptance of the offer, subject to the period being amended to the first ten years of the working of the grid scale of charges. The total saving in the first year is estimated at £3,500.

New Zealand.—WELLINGTON ELECTRICITY SALES.—It is reported in the Australian *Electrical Engineer and Merchandiser* that the Wellington Electricity Supply Department sold 56.3 million kWh in 1934-35, as compared with 50.1 million kWh in the previous year, representing an increase of 12 per cent. There was a net profit for the year of £14,276 (£13,435 in 1933-34).

AUCKLAND POWER BOARD.—The Board sold 138.6 million kWh during the year ended March 31st last, as compared

with 129.6 million kWh in 1933-34 (7 per cent. increase). The Board embarked upon an electric cooking campaign, as a result of which 500 additional cookers were installed. Reductions in tariffs representing an annual decrease in revenue of nearly £45,000 have been recommended.

Oswestry.—OPPOSITION TO NORTH WALES BILL.—The North Wales Power Company's Parliamentary Bill is being opposed by the Town Council on the grounds that it would not be in the interest of consumers.

Sheffield.—EXTENSIONS.—The Electricity Committee has approved mains extensions costing £8,609. A loan of £250,000 for additional generating plant at the Neepsend station has been sanctioned.

Shipley.—SPECIAL HEATING TARIFF.—Electricity is to be supplied for heating purposes to consumers also taking a supply for applications other than heating, at the rate of 0.3d. per kWh. This rate is charged subject to certain restrictions regarding hours and minimum loading.

LOAN.—Sanction has been obtained by the Electricity Committee to a loan of £10,000 for extensions.

Stoke-on-Trent.—CHANGE-OVER.—The electricity supply to Newcastle Street, Burslem, and the California Works of the Berrisford Engineering Co., Ltd., is to be changed over at a cost of £4,300.

MAINS EXTENSIONS.—The Electricity Committee is to extend mains and provide sub-stations at a cost of £10,750 to improve the supply in the East Longton and Sandford Hill districts. Mains are also to be extended and sub-station equipment provided at a cost of £8,600 to improve the supply in the Longport and Brownhills areas, and similar work is to be carried out at Wolstanton at a cost of £3,350.

Loans of £17,000 for mains and plant and £2,445 for sub-station equipment have been sanctioned and the Electricity Committee is to seek sanction to borrow £100,000 for general mains and services.

TRANSFORMER ALTERATIONS.—The transformer capacity at the Porthill sub-station is to be increased at a cost of £550.

Traction

Belgium.—MORE TROLLEY-BUSES.—Following the example of Liége and Antwerp, two services of trolley-buses have recently been started in Seraing.

Bolton.—TRAM TRACK ABANDONMENT.—The Great Lever tram route is to be abandoned, buses taking over the service. The track in Station Street (Crook Street to Trinity Street), however, is to be relaid.

Chile.—SANTIAGO UNDERGROUND RAILWAY SCHEME.—It is reported in the *Railway Gazette* that a project put forward a little over six years ago for replacing the numerous railway and tramway lines around Santiago by an underground railway, about 16 km. long, with a view to relieving the traffic congestion in the streets, has again been revived, and the details of the scheme are stated to be under consideration by Señor Juan Lagarruigue, general manager of the State Railways, and the Lord Mayor. It is proposed that the scheme should be financed jointly by the State Railways, the Government and the Municipality. To the sum subscribed in this way would be added the value of the land made available by the removal of the existing surface lines and the transfer of the Alameda station to another site. According to the original plan, the line was to consist of a double-line system, each line in a separate tunnel, equipped with electric signals and all the latest safety devices.

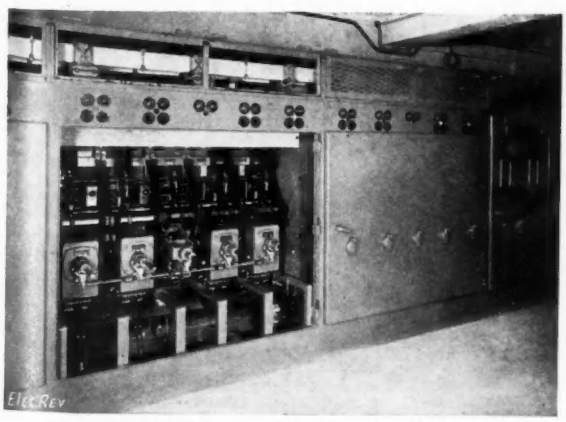
Darlington.—NO TROLLEY-BUSES TO LINGFIELD LANE.—On the grounds that it could not be carried out without loss of money, the Transport and Electricity Committee has dropped a scheme for extending its trolley-bus service from the existing terminus to Lingfield Lane.

G.W.R.—ELECTRICAL PUMPING PLANTS.—In a report on developments on the G.W.R. system during the past year it is mentioned that automatically controlled, electrically driven pumping plants have been installed to replace steam pumps at Abercynon, Aldermaston, Kemble, Radstock, and

A French Supply Company's Headquarters

AN interesting electrical installation has just been completed in the new offices of the Compagnie Parisienne de Distribution d'Electricité, at which the connected load amounts to 3,050 kW. A private sub-station in the basement is connected to the 12-kV distribution system, and there are three groups of transformers, each comprising two transformers of 500 kVA single-phase, besides two 750-kVA transformers for the heating circuits.

The cables are protected by a cut-out switch of the water type, the use of oil being avoided on account of fire risk. By-pass connections permit any transformer to be connected to one of the three cables, while the transformers feed through a set of bus-bars to the low-voltage switchboard of the enclosed type with fifteen sets of switches. Extremely large bars are required to carry the current to the points at which it is to be utilised, and for this reason the connections running from the switchboard in the basement to the top of the building are vertical bare copper bus-bars arranged in two sets, one in a protecting wire cage at the back of a lift shaft and the other at the back of the shaft of a small paper lift. The total weight of the bars, including supports, amounts to ten tons.

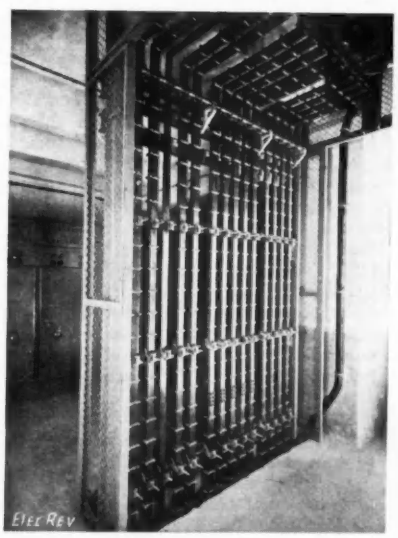


A view of the l.v. cabinet in the sub-station

In order that there should be no risk of fire all inflammable material was avoided in the construction of the bars and their supports. These supports are of steel, insulated with mica. As the short-circuit current at the transformers might amount to something like 30,000 A, it was necessary to take special precautions in spacing the bars and their supports, and the ties around the groups of bars.

The building is heated electrically in three ways, namely, hot-water central heating, hot-air central heating and local radiators. One reason for using different methods is that the installation, being much larger than anything which has ever before been attempted in Paris, is intended to serve for experimental purposes, and a comparison between the different methods is to be made.

The hot-water installation comprises two 15,400-gal. boilers, which are heated by six groups (total capacity 1,500 kW). The water is mixed with water returning from the radiators in a proportion which is determined by an electrically controlled valve according to the temperature of the rooms. At night the valves are closed by clockwork, to be reopened in the morning at the proper time to give the desired temperature by the time the office staff arrives. The local radiators, generally "Calrod" units, are placed in niches under the window sills. They are connected to the vertical bus-bars and to the general distribution system of the building.



The vertical bus-bars

The lighting has been calculated to approximate as closely as possible to daylight. For this purpose the lamps are placed in special ramps above the windows. They are tubular, containing a metal filament in a vacuum, and are housed in reflectors in front of which a diffusing glass is placed. For the lighting of the corridors lamp caissons are placed above the cabinets.

The wires used are insulated by a layer of woven asbestos impregnated with silicate and painted to render it water- and moisture-proof. The lamps are connected to the circuits in the caissons by means of plug and jack devices, so that alterations in the arrangement of the circuits or their balancing are facilitated.

Welshpool, and electric motors have been fitted to the pumps at Bristol (Fox's Wood), Maiden Newton, and Penzance. Semi-automatic electric motors have also replaced the oil-engine drives to the pumps at Cardigan and Wellington, and an electrically driven centrifugal booster pump for water-softening and fire purposes has been installed at the engine shed at Reading. New electric pumps are now being provided at the hydraulic power stations at Cardiff Docks.

Irish Free State.—ELECTRIC RAILWAY SIGNALLING.—Our Irish correspondent reports that electric colour-light signalling, controlled from one central box, has been put into operation on the Great Southern Railway system between Tara Street, Westland Row, and Lansdowne Road stations, Dublin.

Liverpool.—CRITICISM OF TRANSPORT SERVICES.—Following criticism in the City Council of the running of the transport services in Liverpool, Mr. W. G. Marks, the manager of the Transport Department, has presented to the Transport Committtee a report in reply. In this, according to the *Liverpool Post*, he states that it is untrue that nothing has been done during the past eighteen months to improve the services. He points out that when he became manager various sections of the Department were disorganised, and much of this has since been remedied, while the rolling stock has been overhauled and improved. Dealing with the traffic section, Mr. Marks points out that although the services are still irregular, there is a greater degree of regularity than previously. He indicates the causes of the irregularity of services and states that a report on which he and his staff have been engaged for several months will contain suggestions towards the relief of congestion and the securing of a better service. It is interesting to note that the Liverpool tram-cars provide an average penny ride of 2.085 miles, which is claimed to be the largest in Great Britain.

Communications

Australia.—BROADCASTING COMMISSION.—The third annual report of the Australian Broadcasting Commission states that the revenue for the last financial year amounted to £405,534. The principal item of expenditure was for artists' fees and programme costs, amounting to £171,296. The net surplus for the year was £95,078, and the excess of assets and reserves over current liabilities is £147,401. Of the surplus of £95,078, £95,000 has been transferred to the reserve for buildings, which now amounts to £145,000. The increase in licences in the year 1934-35 was 122,693, compared with the record of 129,682 in 1933-34. The number of listeners' licences in force at June 30th, 1935, was 721,852, representing 10.74 per cent. of the population. South Australia now has the highest proportion of listeners to population, its percentage being 12.97.—The Australian *Electrical Engineer and Merchandiser*.

Denmark.—A NEW CABLE.—A report from our Copenhagen correspondent states that the Jysk Telefonaktieselskab has laid a new underground cable between Aarhus and Viborg at a cost of £60,000. It is equipped with a core suitable for the transmission of music for broadcasting.

Great Britain.—TELEPHONE DEVELOPMENT IN THE SHETLANDS.—The G.P.O., in a letter to Shetland County Council in connection with the Council's inquiry regarding the provision of telephone facilities for the islands of Foula and Papa Stour, states that consideration has recently been given to the general question of providing telephonic communication for the more remote islands, including Shetland, and that the position is being examined in detail to determine how such services can be provided on an economic basis.

THE COST OF TELEPHONE PUBLICITY.—The Appropriation Accounts of the G.P.O. Revenue Departments for the year ended March 31st, 1935, show that £113,000 was spent on telephone publicity.

India.—TELEPHONE DEVELOPMENT PLANS.—The Government of India has decided to spend Rs.50 lakhs during the next year on the development of telephone communications in India by expanding the existing facilities to meet the growing traffic and by opening up new trunk exchanges, states our Bombay correspondent. It is proposed to add carrier channels to the existing outlets, such as Bombay to Ahmedabad, Bombay to Madras, Bombay to Delhi and Delhi to Lahore. New trunk exchanges will be opened at Silchar and Sylhet in Assam, Ahmednagar, Bijapur, and six other places in the Bombay Presidency, Vellore and three other places in the Madras Presidency, Farukabad and three other places in the United Provinces, Mirpurkhas in Sind and Yenangyaung in Burma. In addition to this, the telephone exchanges at Amritsar in the Punjab and at Cawnpore in United Provinces will be developed to meet the rapidly increasing traffic.

INCREASE IN RADIO LICENCES.—The number of radio licences in force in India at the end of 1935 was 40,000, as compared 27,000 at the end of 1934 and 20,000 at the end of 1933.

Trolley-buses for South Africa

FOR the Johannesburg Corporation, Sunbeam Commercial Vehicles, Ltd., have just completed eleven trolley-bus chassis of a new type known as M.F.2.

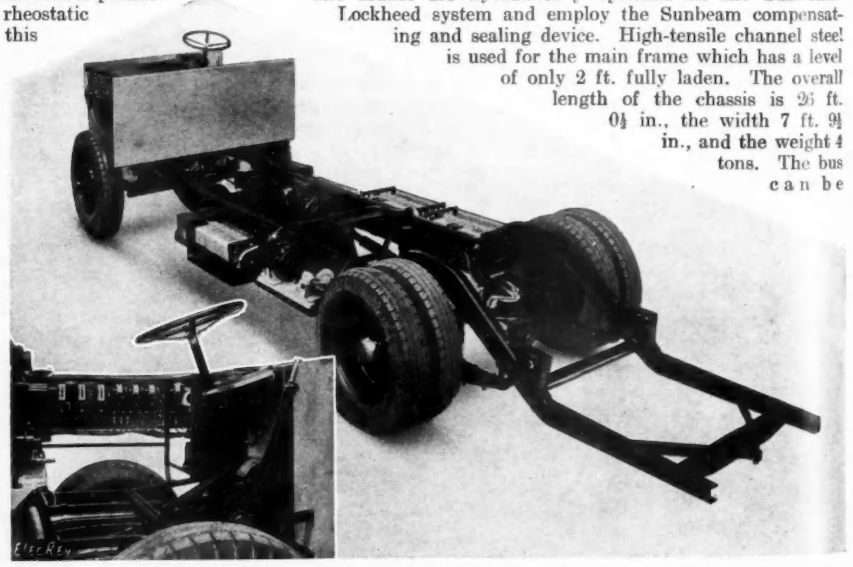
An 80 h.p. 500-V B.T.H. motor is fitted amidships in the chassis on a separate sub-frame bolted to, but insulated from, the main frame. The maximum safe speed is 3,000 r.p.m. (30 m.p.h.=2,646 r.p.m.) and regeneration is possible down to 11 m.p.h., automatic rheostatic braking coming into use below this speed. The plate type controller is operated by the left foot. The associated contactors, also made by the B.T.H. Co., control both the main current and the shunt field. The panels are carried in the driver's cabin in an accessible position, and are enclosed in wooden cabinets having quickly-detachable covers, the terminals being on the front of the panel. A safety relay is brought into operation when the regenerated voltage exceeds that of the line to prevent motor burn-outs.

A trailing skate is provided; this consists of a number of steel rollers threaded on to a steel wire cable and securely anchored to an insulated bracket on the frame. Anchorage is so arranged that should the trailing portion be caught or jammed in a tram rail it will release itself from the frame bracket by lifting up a spring-loaded finger. A three-position switch is incorporated for changing over the circuits from the negative trolley to the trailing skate. Lightning arrestors are fitted and steps have been taken to prevent interference with radio reception. A three-pin socket is provided in the driver's cab for the purpose of leakage testing and, in addition, a red indicator on the dashboard glows when there is leakage in excess of 2½ mA at 600 V.

Another useful device which is fitted is an audible indicator which operates in cases of trolley dewirement. Incidentally, slipper heads are fitted to the poles.

Another safety device is the run-back control which prevents the bus running backward down a hill at a speed greater than 2 m.p.h. in the event of a power failure. A trolley pole deviation indicator is also fitted.

The brakes are hydraulically operated on the Sunbeam-Lockheed system and employ the Sunbeam compensating and sealing device. High-tensile channel steel is used for the main frame which has a level of only 2 ft. fully laden. The overall length of the chassis is 26 ft. 0½ in., the width 7 ft. 9½ in., and the weight 4 tons. The bus can be turned in a 58-ft. circle. The main load for lighting is supplied from a special 1,000-W 24-V generator, the battery serving to supply only the "legal" lights and such accessories as the horn, wiper, bell, &c. A B.T.H. electric speedometer is fitted. For mounting on these chassis the Metropolitan Cammell Carriage & Wagon Co., Ltd., is making 60-seater double-deck bodies.



A general view of one of the new Johannesburg trolley-bus chassis, and (inset) the driving compartment with control and contactor gear

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Amble.—February 12th. Electricity Department. One 20,000-V switch, one 150-kVA transformer, l.p. distribution board, instruments, and auxiliary sub-station equipment. cables, &c. (January 31st.)

Ardsley.—February 29th. U.D.C. Supply of electric lamps for street lighting for a period of one year ending March 31st, 1937. F. A. Brown, Council's surveyor, Council Offices, Tingley.

Argentina.—BUENOS AIRES.—March 9th. State Oilfields Directorate. Construction and equipment of an electric generating station, with Diesel-engine driven alternators and associated equipment, at the Storage Depôt, San Lorenzo. (T.Y. 10366.)*

Australia.—MELBOURNE.—March 3rd. Posts and Telegraphs Department. Insulated wire. (T.Y. 10370.)*

Aylesbury.—February 25th. Electricity Department. Materials for one year. (See this issue.)

Bathavon.—February 14th. R.D.C. Electrically driven pumping plant consisting of two electric motors and switchgear and horizontal-spindle centrifugal pumps. Willcox, Raikes & Marshall, 33, Gt. Charles Street, Birmingham (deposit £2 2s.).

Bedford.—February 24th. Electricity Department. Cables, joint boxes and lamps for the ensuing twelve months. (See this issue.)

Blackburn.—March 2nd. Electricity Department. Cable, wire and meters for twelve months. (See this issue.)

Blackpool.—March 5th. Corporation. Ventilating plants, including electric motors, fans, ducts, &c., at the Anchorsholme and Manchester Square pumping stations. Borough surveyor, Municipal Buildings (deposit £1 1s.).

Brierley Hill.—February 29th. U.D.C. Electrically driven treble ram sewage pump (22,000 gal. per hour) with automatic control gear and accessories, for the Heathbrook pumping station, Wallheath. G. Plant Deeley, 13, Church Street, Stourbridge (deposit £2 2s.).

Bristol.—February 17th. Electricity Department. E.h.p. and l.p. switchgear, and transformers. (January 31st.)

March 2nd. Supply of joint and fuse boxes, cables and wire, for the year ending March 31st, 1937. (See this issue.)

Bromley (KENT).—February 10th. Electricity Department. L.p., e.h.p., and pilot cable. (January 31st.)

Cardiff.—February 11th. R.D.C. Electricity Department. Electrical goods for one year. (January 31st.) Electric wiring under assisted wiring scheme during twelve months ending March 31st, 1937. H. Jackson, electrical engineer and manager, Park House, 20, Park Place (deposit £1 1s.).

February 19th. Transformers. (See this issue.)

February 11th. King Edward VII Welsh National Memorial Association. X-ray equipment for the Sully Hospital and the Pontypridd Tuberculosis Clinic. F. J. Alban, secretary, Memorial Office, Westgate Street.

Cheadle & Gatley.—February 14th. Electricity Department. Materials for one year. (January 31st.)

Dartford.—February 17th. Corporation. Electrode water heater. (See this issue.)

Dundee.—February 12th. Electricity Department. Cable. (January 31st.)

Edinburgh.—February 14th. Corporation. Two electric passenger lifts in new nurses' home, Western General Hospital. City architect.

Egham.—February 22nd. U.D.C. One year's supply of electrical equipment. Engineer and surveyor, Council Offices.

Epsom & Ewell.—February 17th. Electricity Department. L.p. cable. (January 31st.)

Erith.—February 26th. Electricity Department. Twenty-unit 2,840-V switchgear and alterations to existing 22,000-V switch units. (January 24th.)

March 2nd. Materials for twelve months. (January 31st.)

Glasgow.—February 13th. Corporation. Electrical installations in 835 houses and seven shops at Househill Wood. Town Clerk's Office, Room 36.

February 12th. Education Department. Electrical work at Junior Instruction Centre, Yorkhill. Education officer, Property Department, 129, Bath Street (deposit £1 1s.).

Halifax.—February 10th. Improvement Committee. Various works, including electrical, at the King Cross Street development—maisonettes, Block "B." D. T. Lloyd Jones, Borough engineer, Crossley Street (deposit £2 2s.).

Harrogate.—February 22nd. Corporation. Twelve months' supply of electric lamps. C. E. Rivers, Borough engineer and surveyor, Municipal Offices.

Hastings.—February 13th. Electricity Department. Public lighting tower wagon. (January 31st.)

Hornsey.—February 18th. Electricity Department. Two 500-kW motor generator sets, two e.h.p. switches, two e.h.p. feeder switches, and one d.c. feeder switchboard. (January 24th.)

Horwich.—February 12th. U.D.C. Materials and stores for various departments, including electrical. T. Green, surveyor, Public Hall.

Huddersfield.—February 21st. Education Committee. Various works, including electrical, at the Technical College extensions, Queen Street South. Borough engineer and surveyor, High Street Buildings (deposit £3 3s.).

Hull.—February 18th. Transport Department. Supply of stores, including carbon brushes for traction motors, for a period of twelve months from April 1st next. J. Lawson, Transport Offices, Ferensway.

Ilford.—February 24th. Electricity Department. Cables. (See this issue.)

Irish Free State.—DUNDALK.—February 11th. U.D.C. Pumping machinery, electric motors, &c., for the pumping station, St. Alphonsus Road. Town surveyor's office, Town Hall (deposit £5 5s.).

Kettering.—February 24th. Electricity Department. Cable and meters for one year. (See this issue.)

Kingston-upon-Thames.—February 19th. Electricity Department. Material and stores for one year. (See this issue.)

Kirkby-in-Ashfield.—February 22nd. U.D.C. Duplicate electrical pumping machinery, comprising No. 2 vertical-spindle electric (auto-synchronous) motors and No. 2 turbine-type centrifugal borehole pumps (each 30,000 gal. per hr.) with electrical control, switchgear, &c. Elliott & Brown, Burton Buildings, Parliament Street, Nottingham (deposit £3 3s.).

Leeds.—February 14th. Electricity Department. Goods for one year. (January 31st.)

London.—HACKNEY.—February 26th. Electricity Department. Materials for one year. (See this issue.)

BATTERSEA.—February 12th. Electricity Department. Materials for one year. (January 24th.)

Long Eaton.—February 21st. Electricity Department. Materials for one year. (See this issue.)

Manchester.—February 11th. Transport Committee. Cables, wire, armature and field coils, switches, conduit, cells, controller fingers, insulation material, carbon brushes, overhead equipment material, electrodes, &c. General manager, Transport Department, 55, Piccadilly.

Milford Haven.—February 29th. Electricity Department. Electrical materials for one year. (See this issue.)

New Zealand.—WELLINGTON.—April 21st. Public Works Department. Three 10,000-kVA oil-immersed, self-cooled, single-phase transformers with accessories for the Penrose sub-station. (T.Y. 10354.)* 110-kV and 50-kV switchgear. (T.Y. 10355.)*

Northern Ireland.—BELFAST.—February 14th. Electricity Department. Replating regulating cells of storage battery at Harbour power station. (January 31st.)

Perth.—February 17th. Electricity Department. L.p. feeder cables. (See this issue.)

Radcliffe.—February 18th. Electricity Department. E.h.p. and l.p. cables and e.h.p. sub-station switchgear. (January 24th.)

St. Albans.—February 11th. City Council. Electrical installation for extensions to the Sisters' Infectious Hospital, Folly Head. (January 24th.)

Salford.—February 19th. Corporation. Stores. (See this issue.)

February 10th. Two electric lifts at the Hope Hospital. The Steward, Hope Hospital, Eccles Old Road.

Sheffield.—February 14th. Electricity Department. 33-kV switchgear. (January 31st.)

South Africa.—PRETORIA.—February 28th. Union Tender and Supplies Board. Telegraph and telephone line material. (T.Y. 10362.)*

Stoke-on-Trent.—February 12th. Electrical Engineer's Department. E.h.p. sub-station switchgear, transformers, mains and cables. (January 31st.)

Wallasey.—February 24th. Corporation. Transformers. (See this issue.)

Willesden.—February 23th. Electricity Department. Supply of cables, cut-outs, joint boxes, transformers, conduit and fittings and electric wire supplies for a period of twelve months from April 1st next. (See this issue.)

Wimbledon.—February 10th. Two 1,000-kVA and twenty 200-kVA transformers. (January 31st.)

Winchester.—February 12th. Electricity Department. Underground cables for twelve months. (January 24th.)

Wolverhampton.—February 20th. Corporation. Materials for one year. (See this issue.)

Worcester.—February 15th. Electricity Department. Cables, conductors, transformers, &c., for twelve months. (January 24th.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 36, Old Queen Street, London, S.W.1.

Contracts Closed

Birkenhead.—Electricity Committee. Accepted. Wiring sixty-two houses under assisted scheme (£253).—Park Electrical Co.

Bridlington.—Town Council. Accepted. Voltage booster plant for Bempton Lane (£166) and East Road (£125) areas.—Ferranti, Ltd.

Durham.—County Public Assistance Committee. Accepted. Installation of internal telephones at the Lanchester and Durham Institutions.—H. Alderson.

Hull.—Cleansing Committee. Accepted. Six electric vehicle chassis (£3,840).—Electricars, Ltd.

Telephones Committee. Accepted. Bronze wire (£289).—T. Bolton & Sons, Ltd.

London.—BATTERSEA.—Works Committee. Accepted. Traffic signals at five junctions (£1,815).—Automatic Electric Co., Ltd.

L.C.C.—Education Committee. Accepted. Electric lighting and power at schools: Cooper's Lane, Lewisham (£831).—Buchanan & Curwen, Ltd.; Bow Central (£990).—A. Higginbotham & Sons.

Electrical installations at Lamorbey residential school, Sidcup (£417).—Davis, Myer & Co.

Wiring and fittings for electric lighting, &c., in blocks 2 and 3 of dwellings in the Nile Street area, Shoreditch:—

	£
J. H. Plant, Ltd. Accepted	**546**
Samuel Reed & Sons	615
Coleby & Co., Ltd.	641
A. Gardener	671
Basinghall Electric Co., Ltd.	700
Freeman Electrical Co.	734
C. J. Ferguson & Sons, Ltd.	932

Accepted. Main cables, &c., for re-arrangement of main distribution system for lighting and power at the Paddington Hospital (£624).—Malcolm & Allan (London), Ltd. This was the lowest of nine tenders, the highest being £788.

Middlesex.—Highways Committee. Accepted. Traffic signal alterations at Willesden Lane (£652), and traffic signals at five junctions (£3,445).—Automatic Electric Co., Ltd.

Health Committee. Recommended. Telephone battery for West Middlesex Hospital.—Chloride Electrical Storage Co., Ltd.

Accepted. Ward signalling apparatus.—T. Clarke & Co., Ltd.

Rhyl.—U.D.C. Accepted. Twelve months' supply of l.p., p.i., s.t.a. cable.—W. T. Henley's Telegraph Works Co., Ltd.

Salford.—Light, Heat and Power Committee. Accepted. Electric vehicles.—Electricars, Ltd. (£281); Arrowsmith Motors, Ltd. (£330).

Finance Committee. Accepted. Additions to telephone installation at the Town Hall (£216).—Reliance Telephone Co., Ltd.

Sheffield.—Electricity Committee. Accepted. Two water-tube boilers for the Neepsend power station (£140,312).—Stirling Boiler Co., Ltd.

Shipley.—Electricity Committee Accepted Two transformers (£138 each).—Foster Engineering Co., Ltd.

Stoke-on-Trent.—Housing Committee. Accepted. Electrical wiring and fittings at 114 houses on the Abbey Hulton estate (£463).—Edston Electric.

Sunderland.—R.D.C. Accepted. Electric lighting at the Isolation Hospital, Hylton Road (£450).—Gray Bros.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, February 13th. Grosvenor House, W.1. 7 for 7.30 p.m. Annual dinner.

Meter and Instrument Section.—Friday, February 7th. Institution, London. 7 p.m. "Remote Control of Power Networks." Messrs. G. A. Burns and T. R. Rayner.

Sheffield Sub-Centre.—Friday, February 7th. Royal Victoria Hotel, Sheffield. Annual supper-dance.

Mersey and North Wales (Liverpool) Centre.—Monday, February 10th. Central Hall, Liverpool. 7.30 p.m. Faraday Lecture. "Television—An Outline." Dr. E. Mallett.

North-Eastern Centre.—Monday, February 10th. Armstrong College, Newcastle-upon-Tyne. 7 p.m. "Recent Developments in Long-Distance Telephony." Mr. A. C. Timmis.

Western Centre.—Monday, February 10th. Merchant Venturers' Technical College, Bristol. 6 p.m. "Equipment and Performance of Steel-Tank Rectifier Sub-Stations Operating on the London Underground Railways." Mr. A. L. Lunn. Tuesday, February 11th. Royal Empire Society Rooms, Bristol. Joint meeting with the South-Western Centre of the Institution of Post Office Electrical Engineers. "Works Planning." Mr. B. C. H. Rumley.

North-Western Centre.—Tuesday, February 11th. Engineers' Club, Manchester. 7.15 p.m. Joint meeting with the Institution of Post Office Electrical Engineers. "Ultra Short-Wave Radio Telephone Circuits." Messrs. D. A. Thorn and H. T. Mitchell.

Scottish Centre.—Tuesday, February 11th. Royal Technical College, Glasgow. 8 p.m. Faraday Lecture. Paper by Dr. E. Mallett.

Dundee Sub-Centre.—Thursday, February 13th. University College, Dundee. 7.30 p.m. "A Review of Recent Developments in Rural Electrification." Mr. D. Ross.

Electrical Power Engineers' Association (*London Technical Group*).—Monday, February 10th. Caxton Hall, S.W.1. 7.15 p.m. "Feed Water Systems." Mr. J. B. Sims.

Association of Mining Electrical Engineers.—Tuesday, February 11th. Junior Institution of Engineers, S.W.1. 6.30 p.m. "Insulating Oils." Mr. A. L. Read.

Illuminating Engineering Society.—Tuesday, February 11th. Institution of Mechanical Engineers, S.W.1. 7 p.m. "Classification of Symmetrical Light Distributions." Mr. H. Buckley. "Thermal Tests for Illuminating Glassware." Messrs. S. F. Dunkley and W. R. Stevens.

Institute of Marine Engineers.—Tuesday, February 11th. The Minories, E.C.3. 6 p.m. "Notes on the Turbo-Electric Propulsion Equipment of the *Normandie*." Monsieur E. Roth.

Electrical Development Association (*Mid-East England Area*).—Wednesday, February 12th. Leeds. Annual general meeting and luncheon.

Scottish Area.—Friday, February 14th. Edinburgh. Annual general meeting and luncheon.

Institution of Engineers-in-Charge.—Wednesday, February 12th. St. Bride Institute, E.C.4. 7.30 p.m. "The Cause and Prevention of Industrial Accidents." Mr. J. Ranger.

Institution of Heating and Ventilating Engineers.—Wednesday, February 12th. London School of Hygiene and Tropical Medicine, W.C.1. 7 p.m. "Ventilation of the Mersey and Other Tunnels." Prof. J. S. Haldane.

British Electrical and Allied Industries Research Association.—Friday, February 14th. Savoy Hotel. W.C.2. 12.45 for 1 p.m. Annual general meeting and luncheon.

Electrical Engineers' Ball.—Friday, February 14th. Grosvenor House, W.1.

Association of Supervising Electrical Engineers.—Saturday, February 15th. Trocadero Restaurant, W.1. Annual dinner and reunion.

Notes

Electrical Education in Schools

To promote the study of the domestic uses of electricity the Electrical Association for Women has evolved a scheme whereby, for a fee of one guinea, schools may be affiliated to it and receive a special service of free literature, lectures and specially organised competitions. Already twenty-four schools have attached themselves to various branches of the Association. It is announced that as the first of the competitions, an essay on "Life In An All-Electric Age" is to be written, the Lady Mount Temple Cup (presented by Lady Mount Temple, a past president of the Association) being held by the school from which the winning essay is sent, while cash prizes of £2 2s., £1 1s., and 10s. 6d. are being awarded to the authors of the best three essays. The closing date for the competition is October 31st next, and Miss K. B. Baster (late inspector, Board of Education), Councillor Mrs. Gregory (chairman, E.A.W.) and Mrs. Pender Chalmers (vice-chairman, E.A.W.), are to act as judges.

The Institute of Transport

This Institute announces that its annual dinner will be held on April 3rd at the Connaught Rooms, W.C.2. The joint meeting with the British section of the Société des Ingénieurs Civils de France will take place on March 2nd.

Fatalities

An inquest was held at Hammersmith Coroner's Court, before Dr. Edwin Smith, on February 3rd on William Henry Reid (26), gasfitter, Paddington, and a verdict was returned of accidental death while at work, as the result of a defective electric lamp. A gasfitter who was working with the deceased at the time of the accident said they were repairing gas pipes in a flat at Chelsea on January 29th. Reid was screwing an elbow into a joint to rig up the pipe for the meter and an electric table lamp was between them on the floor. Reid moved his foot and caught the flex of the lamp, and he put his left hand out to hold it. He had a pair of grips in his right hand over the gas pipe, and as he touched the lamp he shouted and rolled over. Witness immediately switched off the current and went for assistance, but Reid proved to be dead when admitted to the hospital. The witness saw oxygen applied at the hospital, but the ambulance men did not try artificial respiration. Mr. Forbes Jackson, M.I.E.E., electrical engineer to the London County Council, said he had examined the table lamp, which was constructed entirely of metal. The flex was worn, so that there was danger of the standard becoming alive. Mr. F. C. Smith, research chemist to the Gas, Light and Coke Co., said he had examined the lamp standard and found the wiring defective, inasmuch as it had been bared too much when connected. Assuming Reid was making contact with a gas pipe, a dangerous state of affairs would be set up. Dr. William Leslie, medical officer at St. Luke's Hospital, said that death was very rapid, and was due to acute heart failure, following electric shock. There was slight charring and blistering on the right hand and an abrasion on the other hand. The owner of the flat said that the room was let furnished to an old lady, who put the lamp in two years ago. He believed she bought it as it was and simply plugged it into the ceiling holder. She had carried the standard about the room from place to place and had not complained of shocks.

The Paris correspondent of *The Times* reports that a man and his three children were killed by an electric shock, and his wife was severely burned, at Biarritz on February 2nd by the fall of a h.p. line, which came into contact with the electric-lighting mains of their house. These were exposed overhead wires, and the line was blown down by the gale. The wire of a reading lamp was twisted round an iron bedstead on which the children were sleeping, and this communicated the current to them. The father was killed in trying to drag them away.

Appointments Vacant

Borough electrical engineer for Loughborough.

Assistant technical engineer for Belfast Electricity Department.

Working foreman electrical engineer for Cornwall Mental Hospital, Bodmin.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

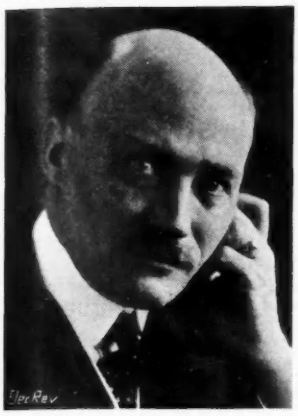
Q-RAY radium pad.
MANNING-MERIDAN coffee percolator.
CRESLEY or CRESSWELL eliminator.
Spot soldering plant—electrical.
CONVERSOR telephones.

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Dr. C. V. Drysdale, C.B., O.B.E., M.I.E.E., has been awarded the Duddell Medal by the Council of the Physical Society for his distinguished work in connection with electrical and optical instruments. Dr. Drysdale, who is an old student of the City and Guilds College, was for some time closely associated with Messrs. Nalder Bros. and Co. In 1899 he took charge of the Electrical Engineering and Applied Physics Department of the Northampton Institute, Clerkenwell, and in the following year started the first Technical Optics Department at that Institute, with a lens-grinding workshop. He was vice-chairman of the Jury on Electrical Instruments at the St. Louis Exhibition, president of the Optical Society in 1904, and examiner to the Spectacle Makers' Company from 1901 to 1929. In 1915 he entered into partnership with Mr. H. Tinsley for the production of instruments for the War, but at the end of 1917 he was called to the Admiralty Experimental Station at Harwich for anti-submarine research. He became Scientific Director at the Admiralty Experimental Station at Shandon in 1919, and from 1921 to 1929 was Superintendent of the Admiralty Research Laboratory at Teddington, during which period he collaborated with Mr. A. C. Jolley in writing a book on electrical measuring instruments; he also edited the *Journal of Scientific Instruments* from 1925 to 1928. He held the appointment of Director of Scientific Research to the Admiralty from 1929 until his retirement last year. He has been responsible for the design of numerous devices of an electrical and optical nature.



[*Elliott & Fry*
Dr. C. V. Drysdale

Mr. A. H. Carmichael, of the British Thomson-Houston Co., Ltd., was called to the Bar of the Middle Temple on January 27th. Mr. Carmichael is well known in E.L.M.A. circles as B.T.H. representative on a number of committees of that Association.

The friends of **Mr. H. C. Rawson,** of Messrs. Ismay (Rawson), Ltd., Sterling Works, Dagenham, will learn with regret that he is ill and will be laid up for several weeks.

Mr. B. W. Leak, M.I.E.E., after twenty-five years' service with the British Thomson-Houston Co., Ltd., and until a few months ago general manager of its branches in Egypt and Palestine, has now left the company to take up partnership in an engineering and contracting firm in Egypt. Mr. Leak received his technical training at Finsbury Technical College, under the direction of the late Prof. Silvanus Thompson, with whom he was engaged for a year in special research work. In 1910 he commenced his practical training with the B.T.H. Co. He had control of the Egyptian branch of the company for fifteen years, and during that period secured many important contracts. He was transferred to the company's head office in October last.

Mr. B. W. Leak

Mr. **Norman T. Smith,** engineer and manager to the Kirkcudbright County Council Electricity Department, has been recommended by the South Shields Corporation Electricity Committee for the appointment of borough electrical engineer at a salary of £700, rising to £800. There were forty-three applications for the post.

Mr. **W. G. Lambert,** connected with Banbury & District Electric Supply Co., Ltd., at Banbury power station for the past twelve years, has terminated his service with the company, and was recently presented by his colleagues with a canteen of cutlery as a memento. The presentation was made by Mr. J. H. Davies, district representative of the S.W.S. Electric Power Co., Ltd., which controls the undertaking.

Mr. E. Miskin, who has joined Messrs. Bratt, Colbran, Ltd., has been appointed electrical sales manager and not electrical sales *engineer*, as reported in our January 24th issue.

Mr. C. F. Street has been appointed managing directer to United Telephone Cables, Ltd., in succession to Col. Sir Thomas Purves. He received his early practical training at the Royal Arsenal, Woolwich, with Messrs. Peter Brotherhood & Co., and at sea, and his technical training at the Central Technical College, South Kensington (1903 to 1906). He was employed in the Engineering Department of the National Telephone Co. until 1912, and from then until 1921 he was engaged in the Engineer-in-Chief's office of the G.P.O., when he was appointed telephone cable engineer to Messrs. Johnson & Phillips, Ltd. He took up the position of secretary to the Telephone Cable Makers' Association in 1934.

[*Elliott & Fry*
Mr. C. F. Street

Mr. A. W. Clegg, borough electrical engineer, Accrington, has been recommended by the Corporation Electricity Committee for an increase in salary to £1,000 per annum.

Mr. P. F. Grove, assistant engineer to Messrs. Kennedy & Donkin, has been appointed electrical engineer to Messrs. H. A. Brassert, who are engineers to the iron and steel industries. Mr. Grove joined the staff of Messrs. Kennedy & Donkin in 1928 and was formerly an assistant engineer in the Steelwork Section of the English Electric Co., Ltd.

Mr. K. D. Weguelin, of Wolverhampton, has been appointed by the Birkenhead Corporation Electricity Committee as motors and hiring superintendent in the Electricity Department at a salary of £369 per annum.

The retirement of **Mr. J. A. Bell,** electrical engineer to Aberdeen Corporation, in April next, under the superannuation scheme, was considered by the Corporation Electricity Committee on January 29th, and the matter was referred to a sub-committee.

Mr. C. V. Hill, the author of the article on "Repulsion Induction Motors," on page 193 of this issue, is technical adviser on a.c. machines in the Industrial Sales Department of the British Thomson-Houston Co., Ltd., Rugby. He received his early training at Liverpool University, and after graduating in 1916 entered the B.T.H. Test Department. During the war Mr. Hill was engaged on electrical work in the Submarine Division of the R.N.V.R., returning to the B.T.H. Co. at the cessation of hostilities to enter the a.c Engineering Department of the company. He took up his present position in 1926.

Mr. C. V. Hill

We understand that **Col. K. Edgcumbe** has given instructions for his house, Aldenham Grange, Hertfordshire, with twelve acres of ground, to be sold by auction this spring.

Mr. E. K. Balcombe, managing director of Messrs. A. J. Balcombe, Ltd., has returned from the United States, where he visited the Crosley refrigerator factory, Cincinnatti, Ohio, for which his company is sole distributor in the United Kingdom.

Mr. W. Davies, deputy electrical engineer and manager to the Tredegar Urban District Council, was married on February 2nd, at Blackwood, Mon., to Miss Florence M. Tomkins.

Mr. H. B. Riggall has been elected to the board of Messrs. Ruston & Hornsby, Ltd. He has been connected with the company for many years, latterly in the capacity of commercial manager. **Mr. T. W. Fairhurst** is relinquishing his position with Messrs. Crompton Parkinson, Ltd., and has also

been elected to the board. He will assume duty as sales director as from March 1st.

Mr. H. A. Aston informs us that he has resigned his position as general sales manager with J. A. Crabtree & Co., Ltd.

Sir Alexander B. Swan and **Mr. S. Bell** have joined the board of the Craigpark Electric Cable Co., and Sir Alexander has been appointed chairman in succession to Dr. Magnus Maclean, who has resigned owing to indifferent health, but will remain on the board.

Alderman T. Hey, J.P., was last week presented with an electric clock and a wallet on behalf of the staff of the Halifax Electricity Department, in recognition of his long service as chairman of the Electricity Committee. The presentation took place at the electricity showrooms, and Mr. G. A. Vowles, the borough electrical engineer, who presided, said that Ald. Hey was first elected to the Council in 1895 and was still serving, with a break of only one year in 1913. He was chairman of the Electricity Committee from 1901 to 1906, and again from 1921 to 1935. Since he took control the undertaking had never looked back. Mr. T. M. Blackburn made the presentation.

Obituary

Mr. F. R. Low.—The death occurred on January 22nd in New Jersey, at the age of seventy-five, of Mr. F. R. Low, who for a very long period was one of the foremost technical journalists in the United States, specialising in power subjects. For forty-two years he was associated with our contemporary, *Power*, of which he was one of the editors as long ago as 1888; he was appointed its editor emeritus at the age of seventy, and continued writing for the Press on power engineering matters practically to the last. He wrote four technical books, and had a number of inventions to his credit; he was president or member of numerous associations or committees. He began life as a clerk and stenographer, but turned to the study of engineering subjects in his spare time, and thus qualified for specialising in all kinds of questions of interest to the practical power station and engine-room worker.

The Situation in Brazil

IN a report on economic conditions in Brazil (Stationery Office, 2s. 6d. net), Mr. E. M. Harvey (Commercial Secretary to H.M. Embassy, Rio de Janeiro), and Mr. N. A. P. Sands (H.M. Vice-Consul, Rio de Janeiro), state that the economic history of Brazil during the past twelve months has been one of almost unrelieved tension, characterised by efforts on the part of the Government to relieve the steadily increasing pressure of foreign commitments due to a declining trade balance and the consequent scarcity of exchange. Although the total volume of exports exhibited an increase during the first eight months of 1935, as compared with the corresponding period of 1934, the value in gold has decreased slightly owing to the depreciated rate of exchange. At the same time imports have increased, both in volume and gold value, with the result that the balance of exports over imports was nearly £2,000,000 less than for the first eight months of 1934.

Internally, the commercial conditions have been unusually good, and there is no unemployment. With the exception of jute, the chief industries have been fully occupied. Their expansion and the development of new industries is creating a demand for plant, machinery, specialised raw materials, and semi-manufactured goods at the expense of many of the staple products for which Brazil has offered a market in the past. The building trade has experienced a boom, accompanied by increased activity in land sales. The report includes an analysis of the import trade in 1932, 1933, and 1934, from which the electrical items given below have been extracted: —

	(Met. tons) 1934.	Inc. or dec.
Apparatus and appliances for electric lighting—		
Total	1,851	+232
From United Kingdom	220	− 35
„ Belgium	290	+209
„ U.S.A.	578	+ 75
„ Germany	487	+ 65
Electric dynamos and generators—		
Total	636	+389
From United Kingdom	128	+ 85
„ Germany	228	+162
„ U.S.A.	164	+103
Electric motors—		
Total	540	− 36
From United Kingdom	132	− 29
„ U.S.A.	103	− 10
„ Germany	88	+ 40
Transformers—		
Total	395	+238
From United Kingdom	75	+ 47
„ U.S.A.	123	+108
„ Germany	68	+ 23
Electric cables and wires—		
Total	1,240	+628
From United Kingdom	968	+610
„ U.S.A.	71	+ 13
„ Germany	76	− 18
Radio apparatus—		
Total	678	+247
From United Kingdom	11	+ 8
„ U.S.A.	531	+181
„ Holland	122	+ 67
„ Germany	13	− 8

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Heating Elements, Ltd.—Private company. Registered January 24th. Capital, £1,000 in £1 shares. Objects: To carry on business as designers and manufacturers of electrical heating units, electrical contractors and general electrical engineers, &c. The subscribers are: W. Whowell, The Laurels, Holmfield Road, Leicester; and R. Dunn, Eagle House, Frier Lane, Leicester. Secretary: V. O. Mcquillin.

J. Hower & Son, Ltd.—Private company. Registered January 25th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, electrical engineers, dealers in and hirers out of amplifiers loud speakers and microphones, manufacturers of and dealers in cinematograph machines, &c. The subscribers are: C. Hodge, 232, Barden Lane, Burnley; and J. A. Parkinson, 134, Manchester Road, Nelson. Secretary: Charles Hodge.

Carlile & Co., Ltd.—Private company. Registered in Dublin January 27th. Capital, £1,000 in £1 shares. Objects: To acquire the business of electrical and plumbing contractors now carried on at 24, Drury Street, and 13, Lower Abbey Street, Dublin, The directors are: J. H. Carlile, J. Carlile, and Mrs. L. Carlile, all of 1, Ashfield Avenue, Ranelagh, Dublin.

Apex Construction, Ltd.—Private company. Registered January 30th. Capital, £100 in £1 shares. Objects: To carry on the business of electrical, chemical and general engineers, &c. The directors are: E. A. Fox (permanent), 4, Glynde Road, Bexleyheath, Kent, and C. Dennett, 5, Holly Crescent, Beckenham, Kent. Registered office: 133, Oxford Street, W.1.

H. & P. Marsden, Ltd.—Private company. Registered January 31st. Capital, £1,000 in £1 shares. Objects: To acquire the business of electrical and radio dealers and engineers carried on by H. E. C. Marsden and P. C. G. Marsden at 79, High Street, Waltham Cross, as "H. & P. Marsden." The permanent directors are: H. E. C. Marsden, 26, Eleanor Cross Road, Waltham Cross; P. C. G. Marsden, 131, Bullsmoor Lane, Waltham Cross; and F. R. Marsden, 65, York Road, Waltham Cross. Solicitors: Jessopp & Gough, Waltham Abbey.

Utilities (London), Ltd.—Private company. Registered January 31st. Capital, £1,000 in £1 shares. Objects: To carry on business as sellers, manufacturers and producers of, dealers in and contractors for electrical apparatus, instruments and machines, refrigerators, air conditioners, &c. The subscribers are: R. G. Smith, 2, Newman Street, W.1; and J. G. G. Noble, 18, Green Moor Link, Winchmore Hill, N.21. Solicitors: Godden Holme & Ward, 34, Old Jewry, E.C.

J. E. Kavanagh (Birmingham), Ltd.—Private company. Registered January 29th. Capital, £4,000 in £1 shares. Objects: To acquire the business of factors of and merchants in motor and electrical accessories carried on by J. E. Kavanagh & Co. at Hurst Street, Birmingham. The subscribers are: J. E. Kavanagh, 100, Shirley Road, Acocks Green, Birmingham; and K. S. Bourne, The Poplars, Ridgacre Lane, Quinton, Birmingham. Registered office: 119, Hurst Street, Birmingham.

Returns of Electrical Companies

Electrical Facilities, Ltd.—The nominal capital has been increased by the addition of £100,000 in £1 ordinary shares beyond the registered capital of £100,000. This "private" company was registered on January 31st, 1933. To March 27th, 1935, 60,000 shares had been issued, £15,000 (5s. per share) paid up in cash thereon. The shareholders at the date of the return included: British Insulated Cables, Ltd. (18,800); W. T. Henley's Telegraph Works Co., Ltd. (24,800); and the Telephone & General Trust, Ltd. (9,900). A further 40,000 shares were allotted, payable in cash and fully called up on October 16th, 1935. The allottees included the three above named companies with 16,535, 16,535 and 6,600 shares respectively.

H. C. Baker, Ltd.—Satisfaction in full on January 18th, 1936, of debenture dated November 18th, 1935, and registered December 7th, 1935, securing £800.

Nelco, Ltd.—Mortgage on land at Merrow, Surrey, &c., dated January 9th, 1936, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

Plessey Co., Ltd.—Debenture dated January 16th, 1936, to secure £30,000, charged on the company's undertaking and property, present and future, including uncalled capital, and

ranking *pari passu* with debentures dated February 10th, 1932, and December 6th, 1933. Holders: Branch Nominees, Ltd.

Neon Luminous Tubes (Lund Signs), Ltd.—Capital, £2,000 in 1,000 ordinary and 1,000 preference shares of £1 each. Return dated December 24th, 1935. 692 preference and 1,000 ordinary shares taken up. £692 paid on 692 preference shares. £1,000 considered as paid on 1,000 ordinary shares. Mortgages and charges, nil.

Switchit Service, Ltd.—Capital, £3,000 in £1 shares. Return dated December 23rd, 1935. All shares taken up. £3,000 paid. Mortgages and charges, £250.

Bideford & District Electric Supply Co., Ltd.—The nominal capital has been increased by the addition of £40,000 in £1 ordinary shares beyond the registered capital of £100,000. Part of this increase is for the purpose of acquiring the whole of the property, undertaking and assets of the Braunton Electric Light & Power Co., Ltd.

Johnson Ross & Co., Ltd.—A. W. Kingsley, Stal House, Judd Street, King's Cross, W.C.1, ceased to act as receiver and manager on November 23rd, 1935. (Notice filed January 24th, 1936.)

Horley & District Electricity Supply Co., Ltd.—Satisfaction in full on June 24th, 1929, of debentures authorised December 30th, 1926, and registered February 1st, 1927, securing £5,000. (Notice filed January 23rd, 1936.)

H. Knowles & Co., Ltd.—The nominal capital has been increased by the addition of £2,500 in £1 ordinary shares beyond the registered capital of £5,000.

Home Installations, Ltd.—The nominal capital has been increased by the addition of £150 in £1 ordinary shares beyond the registered capital of £100.

Radio Instruments, Ltd.—Satisfaction in full on January 20th, 1936, of debenture to Lloyds Bank, Ltd., dated February 16th, 1935, and registered March 1st, 1935. (According to the register of mortgages the debenture registered March 1st, 1935, originally secured all moneys due to bank.)

Drake & Gorham, Ltd.—Satisfaction in full on December 18th, 1935, of charge dated June 20th, 1921, and registered June 27th, 1921. (According to the register of mortgages the charge registered June 27th, 1921, originally secured £12,000.)

Convertors, Ltd.—L. O. Morris, 79, Salisbury House, London Wall, E.C.2, ceased to act as receiver and manager on January 27th, 1936.

Sheffield Rediffusion Service, Ltd.—Capital £100 in £1 shares. Return dated September 16th, 1935. Three shares taken up. £3 paid. Mortgages and charges, nil.

Cannon Electrical Appliances, Ltd.—Capital, £1,300 in 1,000 redeemable preference shares of £1 and 1,200 ordinary shares of 5s. Return dated December 31st, 1934 (filed October 7th, 1935). Eight ordinary shares taken up. £2 paid. Mortgages and charges, nil.

Aeradio, Ltd.—Capital, £500 in £1 shares. Return dated December 31st, 1935. All shares taken up. £500 paid. Mortgages and charges, nil.

Fractional H.P. Motors, Ltd.—Capital, £2,000 in £1 shares. Return dated September 30th, 1935. All shares taken up. £2,000 paid. Mortgages and charges, nil.

De Renzi, Holmes & Co., Ltd.—Capital, £2,000 in £1 shares. Return dated August 30th (filed October 15th), 1935. 1,261 shares taken up. £1,261 paid. Mortgages and charges, nil.

City Notes

The Revo Electric Co., Ltd.—Particulars of this company were published on Wednesday last for public information only, in compliance with Stock Exchange regulations. The company was incorporated in 1907 as the Cable Accessories Co., Ltd., its name being subsequently changed to Revo Electric Co., Ltd. The principal object of the company is the manufacture of, *inter alia*, electric lighting fittings, electric cookers, domestic appliances, switchgear, fans and traffic control and street-lighting equipment. The authorised capital is £500,000 in 10s. ordinary shares. The capital structure has recently undergone considerable modification. At March 31st last the total issued capital was 110,000 ordinary and 50,883 6 per cent. preference shares. Since that date 118,800 £1 shares have been allocated to the ordinary shareholders as a capital bonus, the preference shares have been converted into ordinary shares, and all the shares divided into shares of 10s. denomination. In addition, 140,634 10s. shares have been issued to shareholders at par. In its new form the company will have an issued capital of £350,000. The profits for 1933-34 were £73,211, and for 1934-35, £85,361.

The Singapore Traction Co., Ltd., reports a profit for the year ended September 30th last of £54,473, as compared with £25,032 for the preceding year, to which is added £4,295 brought in, making £58,768. After deducting debenture stock redemption, depreciation and renewals, legal charges, and remuneration payable to the Shanghai Electric Construction Co., Ltd., under the management agreement, and placing £4,000 to taxation reserve, there is a balance of £7,752. It is proposed to pay a dividend of 10 per cent., less tax, on the preference shares on account of arrears, part of which is payable out of the profits of the current year. The arrears of dividend on the preference shares will then amount to 22 per cent. At the annual meeting on February 12th a resolution will be submitted for converting the preference and ordinary shares into stock.

The Chiswick Electric Supply Corporation is holding an extraordinary meeting on February 18th with reference to the sale of its Abervstwyth undertaking, when resolutions will be submitted dealing with the suggested compensation to the board, the voluntary liquidation of the company and the appointment of a liquidator. According to the *Financial News*, on the adoption of the resolutions the liquidator will forthwith make an interim distribution of £1 on each of the outstanding shares of 2s. and it is anticipated that a final distribution of not less than 3s. per share will be possible shortly thereafter.

Broadcast Relay Service, Ltd.—An extraordinary meeting was held on January 31st at which resolutions were passed increasing the authorised capital to £500,000 by the creation of 6,000,000 new shares of 1s. each, capitalising £254,300 of the existing capital reserve and authorising the directors to issue to the shareholders two ordinary shares in respect of each 1s. ordinary share now held. Resolutions were also passed converting the share capital into stock transferable in multiples of 5s.

The British Oxygen Co. is to commemorate its jubilee by capitalising part of its reserves and distributing free to shareholders two fully paid ordinary shares of £1 each for every £7 of ordinary stock held. The share issue will involve the distribution of £552,372 out of reserves, and the new shares when issued will be converted into ordinary stock which will rank *pari passu* with the existing ordinary stock for participation to the full amount in the final dividend for 1935.

The City of Buenos Ayres Tramways Co. (1904), Ltd., reports that an annuity of £70,660 payable by the Anglo-Argentine Tramways Co. has been received and that the net profit for 1935 is £70,519, as compared with £69,721 for the preceding year. The dividend for the year is maintained at 5 per cent., £8,000 is transferred to amortisation fund, and £1,538 is carried forward.

The Railway Finance Corporation, Ltd.—The list was opened on January 31st for an issue of £27,000,000 of 2½ per cent. guaranteed debenture stock, 1951-52, at £97 per cent. This company was incorporated in December last for the purposes of raising and lending money under the agreement between the Treasury and the four main line railway groups.

Ismay Industries, Ltd.—It is reported that the directors have issued 300,000 5s. ordinary shares privately, at 7s. per share, for the expansion of the company's business.

The Jersey Electricity Co.—The Jersey authorities have decided to acquire all the ordinary shares in the Jersey Electricity Co., thus obtaining a controlling interest. According to the *Financial Times*, the price agreed upon is £140,000.

The Northampton Electric Light and Power Co., Ltd., proposes to pay a final dividend of 6 per cent. on the ordinary shares (making 10 per cent. for the year). The annual meeting will be held on February 28th.

The Rushden & District Electric Supply Co., Ltd., has recommended a final dividend of 4½ per cent., making 8 per cent., for the year. The annual meeting will be held on February 28th.

The Direct Spanish Telegraph Co., Ltd., reports an income of £10,616 for 1935, against £10,882, and with expenses and debenture interest taking £3,353, there is a balance of £7,263 (£6,734) plus £642 brought in. The ordinary dividend remains at 6 per cent., less tax, and £1,026, compared with £642, is carried forward. Meeting, February 10th.

Power Securities Corporation, Ltd., reports a net profit, after meeting taxation, for the year 1935 of £101,730, against £100,298 for 1934. The ordinary dividend remains at 7 per cent., and the general reserve again receives £30,000. The balance carried forward is increased from £26,095 to £27,300. Meeting, February 12th.

The London Electric Supply Corporation, Ltd., recommends a final ordinary dividend of 4 per cent., less tax, making 7 per cent. for the year, and the payment of a bonus of 1 per cent., being a proportion of the consumers' benefit under the sliding scale.

The Dublin United Tramways Co. (1896), Ltd., has decided not to pay an ordinary dividend for 1935, against a distribution of 3 per cent. for the previous year. The non-cumulative preference dividend is 6 per cent., less tax, £20,000 is set aside for the mortgage debenture redemption fund, and £9,744 is carried forward (against £17,127).

Stocks and Shares

TUESDAY EVENING.

A LITTLE uncertainty became evident in the markets of the Stock Exchange towards the close of the Stock Exchange Account which ended with the Thursday in this week, but the general tone remains satisfactory. In view of the sustained buoyancy which has characterised most markets for a long period, it is only to be expected that a certain amount of profit-taking will occasionally occur. Apart from the possibility of disturbing events that may happen abroad, and exercise a depressing effect here, there seems to be no reason to expect any diminution in the demand for those stocks and shares which have been in favour for some time. The chairmen of the four of the "Big Five" banks which held their annual general meetings last week took, on the whole, a decidedly confident view of the domestic position and prospects. Their remarks served to emphasise the confidence previously noticeable in Stock Exchange markets. The argument that saturation point has been reached, so far as home industries are concerned, has few supporters. The scope for expansion seems to be ever increasing in many directions. Particularly is this so in the case of the industries concerned with electricity and electrical equipment.

Railway Finance Scrip

The market in gilt-edged stocks is not particularly active, but a rather firmer tendency is apparent. The outstanding event has been the commencement of dealings in the £27,000,000 guaranteed Railway Finance Corporation loan. The price stands at ⅛ discount, stock being readily absorbed at about that price. Stocks of the electricity and transport Boards have remained steady. London Passenger Transport "C" stock is a point easier at 108¼. The Home Railway

market has continued to show considerable strength following the easing of the coal situation and the Southern Railway rating decision.

Electricity Supply Shares

In view of the approach of the dividend season, and of the optimistic view taken of the future of the industry as a whole, the rising tendency of electricity supply share prices has made further progress practically throughout the list. Yorkshire Electric are prominent with a net gain of 2s. 3d. to 48s. 6d. ex-dividend. Electrical Distribution of Yorkshire and North Eastern Electric are both 1s. to the good at 49s. and 36s. respectively. Advances are also marked, but to a lesser extent, in the shares of County of London, London Electric, Edmundson's, and several other companies. Dealings have started in the new "A" £1 ordinary shares of the Palestine Electric Corporation, 200,000 of which were offered to shareholders at 45s. each. The new shares are quoted around 8s. 6d. premium, and the old shares at 54s. 6d. ex rights. The former do not rank for dividend in respect of the year just ended.

The Metropolitan Electric Supply Company has notified the holders of its 4½ per cent. first mortgage debenture stock that this issue will be repaid at 110 on July 31st next. The issue of a new 3 per cent. debenture loan is reported to be imminent.

Cable and Wireless

Cable and Wireless stocks have been amongst the outstanding features in the markets this week. Statisticians and others are hard at work estimating the probable results of the past year's operations, and forecasting the steps which will be taken in respect of dividend arrears. The price of the preference stock has risen a further 5 points to 115. It is believed that earnings in the past year will be sufficient to cover a full year's dividend on the reduced preference capital and leave something over, perhaps ½ or 1 per cent., for the "A" stock. The preference dividend is in arrear to the extent of approximately 12½ per cent. If the preference dividend should be paid in full, and early steps are taken to deal with arrears, the stocks of the combine appear to be destined for further recovery. On this assumption, the "A" and "B" stocks improved by 15s. and 1 to 30½ and 9 respectively.

Manufacturing and Equipment

The market for shares in the electrical equipment and manufacturing companies has continued to be one of the most active in the Stock Exchange. This is due to a variety of stimulating factors. Apart from the general growth of activity in the industries served by, or connected with the electrical equipment and cable manufacturers, the new railway loan is certain to provide substantial additions to their order books. The prices of the shares of the leading companies in this group are mostly higher on the week, although the profit-taking referred to above, left them in some cases below the best. British Insulated Cables, for instance, rose to 108s. before reacting to 106s. 3d., leaving the price with a gain of 6s. 3d. on the week. Enfield Cables fluctuated in a like manner, rising to 128s. 6d. before easing off to 63s. 8d., at which they are 8s. 9d. higher on balance. Rumour predicts the distribution of a bonus of two free shares for every five held. It is pointed out that the sum required for such a distribution would be covered 2½ times over by the share premium and reserve accounts. Arons are 3s. 9d. up at 58s. 9d. Siemens and Telegraph Construction were in steady demand, the former rising 1/6 to 28s. 9d., and the latter 3/6 to 30s. Ericsson Telephones 5s. shares have also been good, with a rise of 1/6 to 38s. 9d. This company's report is due in about a month, and here also there is talk of a possible bonus. General Electric and Crompton Parkinson show no quotable changes. Cromptons fell 3s. to 64s. 6d., after our price-lists were officially published in the Stock Exchange lists. Associated Electricals are a few pence easier.

Baird Television

Reflecting on increasing popularity in Canadian stocks and shares, something of a demand has sprung up for Canadian Marconis. These are regarded in the market as being very much of a speculation, but with prospects which evidently the present day buyers regard as promising. The nominal denomination of the shares is $1. Baird Television new shares are now on offer to holders of the 20 per cent. preferred and the deferred ordinary. Although the lists for subscription to the issue will not close until next Tuesday, February 11th, dealings in the new shares have already started, the price being 1½d. to 6d. premium over the issue price of 2s. 6d. The old preferred shares stand at 3s. and the deferred at 6s.

Miscellaneous Matters

Brazil Traction at 13⅞ are a further 1½ to the good. As mentioned here last week, an improvement is looked for in the Brazilian exchange position and in the rates at present in force for fares. Hydro Electrics are a very lively market; the price has jumped upwards, taking with it the quotation for International Holdings. The latter stood below a dollar not long ago, and is now $2½. The pressure to buy British Vacuum Cleaners has forced the price up to £7, which represents a gain of 30s. on the week. There is evidently much satisfaction with the capital bonus scheme, which gives four new 5s. shares to shareholders in exchange for each existing 6s. share. Victoria Falls have put on another 5s. at 78s. 9d. British Electric Traction deferred has shed 30 points to 1665.

Share List of Electrical Companies

	Nom.	Dividend 1933.	Dividend 1934.	Price Feb. 4	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	3⅞	—	3 17 5
City of London	1	7½	7½	39/–	+6d.	3 17 0
Clyde Valley	1	7	8	46/–	—	3 9 7
County of London	1	10½	10½	58/6	+6d.	3 11 10
Edmundson's 7% Pref.	1	7	7	36/6	—	3 16 9
Do. Ord.	1	7	8	45/6	+6d.	3 10 4
Elec. Dis. Yorkshire	1	9	9	49/–	+1/–	3 13 6
Elec. Fin. and Securities	1	12½	12½	3 7/8	—	3 12 9
Elec. Supply Corporation	1	11	11	3 5/8	—	3 9 0
Lancs Light and Power	1	7½	7½	40/–	+6d.	3 15 0
Lond. Assoc. Electric	1	—	—	36/–	—	3 17 9
London Electric	1	7	8	41/–	+6d.	3 18 1
London Power Deb. Red.	Stock	5	5	110½	+1	4 10 6
Metropolitan	1	10	10	54/–	—	3 14 1
Midland Counties	1	7	7	41/–	—	3 8 4
Mid. Elec. Power	1	8	8	42/6	—	3 15 3
North Eastern Electric Ordinary	1	6	6	36/–	+1/–	3 6 8
Do. 7% Pref.	1	7	7	35/6	—	3 19 0
Northampton	1	10	10	55/–	—	3 12 9
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary	1	10	10	62/–	—	3 4 6
Do. do. 6% Pref.	1	6	6	32/–	—	3 15 0
Scottish Power	1	8	8	43/9	—	3 13 2
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	48/6xd	+2/3	3 6 0
PUBLIC BOARDS.						
Central Electricity 1950–70	Stock	5	5	116xd	—	4 6 2
Do. 1955–75	,,	5	5	120	—	4 3 4
Do. 1951–73	,,	4½	4½	111	—	4 1 1
Do. 1963–93	,,	—	3½	106	—	3 6 0
London Elec. Trans. Gtd.	,,	—	2½	96½xd	—	2 11 10
London & Home Counties, 1955–75	,,	4½	4½	112	—	4 0 4
London Passenger Transport, A	,,	—	4½	127	—	3 11 0
Do. do. B	,,	—	5	130½	—	3 16 8
Do. do. C	,,	3½	4	108½	–1	3 13 9
West Midlands Joint Elec. 1948–68	,,	—	5	116½	—	4 5 10
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	160½	—	5 12 5
Anglo-Am. Tel. Pref.	Stock	6	6	124½	—	4 16 5
Do. Def.	,,	1½	1½	30	—	5 0 0
Cable & Wireless 5½% Pref.	,,	2⅝	4⅛	115	+5	3 11 9
Do. A. 7½% Ord.	,,	Nil	Nil	30½	+⅜	—
Do. B. Ord.	,,	Nil	Nil	9	+1	—
Globe Tel. & Tel. Ord.	10	2½	3½*	15⅞	+⅜	2 4 1
Do. do. Pref.	10	6	6	14⅜	—	4 2 0
Great Northern Tel.	10	20	20	42½	—	4 14 1
Marconi-Marine	1	10	7½	37/6	—	4 0 0
Oriental Telephone Ord.	1	12	12	3¼	—	3 13 10
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	1665	–30	—
Do. do. Pref. Ord.	,,	8	8	174½	—	4 11 8
Brazil Traction	100	—	—	13⅞	+1½	—
Brit. Columbia Elec. Rly. Pfe.	Stock	5	5	98½	—	5 1 6
Mexican Light Common	100	Nil	Nil	2½	—	—
Do. 7% Pref.	100	7	7	3	—	—
Do. 1st Bonds	$500	5	5	50	—	—
Victoria Falls Ord.	1	20	20	3 1/16	+⅛	—
West Riding	1	5	6½	52/6	—	2 9 6
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	58/9	+ 5/8	5 2 2
Assoc. Elec. Ord.	1	4	6	45/–	–6d.	2 13 4
Do. Pref.	1	8	8	39/–	—	4 2 1
Babcock & Wilcox	1	6	8	54/6	—	2 18 9
British Aluminium Ord.	1	5	7½	42/9	–6d.	3 10 2
British Insulated Ord.	1	5	15	5⅜	+ 1/8	2 15 10
Brush Ord.	Stock	Nil	Nil	44½	–2	—
Callender's	1	15	15	4¼	—	3 12 10
Do. 6½% Pref.	1	6½	6½	31/3	—	4 3 2
Crompton Parkinson Ord.	5/–	—	12½	67/6	—	0 10 0
Do. 8% Pref.	1	8	8	38/9	—	4 2 7
Edison Swan 1st Pref.	1	7½	7½	33/9	—	4 9 0
Electric Construction	1	Nil	3½	2	—	1 15 0
Enfield Cable Ord.	1	25	25	6⅜	+ 1/16	3 18 5
English Electric	1	Nil	Nil	22/6	+6d.	—
Do. do. Pref.	1	Nil	Nil	24/6	—	—
Ericsson Tel.	5/–	—	24	38/9	+ 1/16	—
Ever Ready	5/–	35	35	24/6	—	7 2 10
Ferranti Pref.	1	7	7	27/–	—	5 3 8
G.E.C. Pref.	1	6½	6½	33/6	—	3 17 7
Do. Ord.	1	8	10	81/–	—	2 9 8
Henleys	1	30	30	7½	+¼	4 0 0
Do. 4½% Pref.	5	4½	4½	5⅝	—	3 18 3
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	5	7½	50/–	—	3 0 0
Siemens Ord.	1	6½	4	28/9	+ 1/16	2 15 8
Telegraph Construction	£1	Nil	Nil	30/–	+ 1/8	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1933

35749. "Systems for generating high-frequency electrical oscillations." W. J. Polydoroff and Aladdin Industries, Ltd. October 27th, 1934. (440877.)

1934

10469. "Electric condensers." Porzellanfabrik Kahla. May 27th, 1933. (Cognate applications 10470/34, 10571/34, and 10472/34.) (440948.)

10475. "Condensers, more particularly for high-frequency and wireless purposes, and processes for the manufacture thereof." J. E. Pollak (Porzellanfabrik Kahla). April 6th, 1934. (Convention date not granted.) (440949.)

10477. "Electric condensers, more particularly for high-frequency and wireless purposes, and processes for the manufacture thereof." Porzellanfabrik Kahla. May 30th, 1933. (Cognate applications 10479/34, 10480/34 and 10483/34.) (440950.)

10481. "Electric condensers, more particularly for high-frequency and wireless purposes, and processes for the manufacture thereof." Porzellanfabrik Kahla. November 9th, 1933. (Cognate application 10482/34.) (440951.)

10598. "Direct-current dynamo electric generators." G. Ullrich and H. Langkau. April 7th, 1934. (440881.)

11073. "Electro cardiographic apparatus." A. C. Cossor, L. H. Bedford and D. Robertson. April 12th, 1934. (441057.)

16831. "Electric incandescent lamps." S. G. S. Dicker (Naamlooze Vennootschap Splendor Gloeilampenfabriek). June 7th, 1934. (440956.)

19707. "Loud speakers and the like." R. R. Glen. July 4th, 1934. (441061.)

19734. "Battery torches." Batterien und Elementefabrik System Zeiler, Akt.-Ges. July 4th, 1933. (440960.)

19803. "Electric heating elements for ovens, furnaces, or other appliances." G. H. S. Grene and Wild-Barfield Electric Furnaces, Ltd. July 5th, 1934. (440890.)

19894. "Phase-changing arrangements." British Thomson-Houston Co., Ltd., and A. H. Maggs. July 6th, 1934. (441062.)

19916. "Electric test units for use on electrically driven vehicles." Associated Equipment Co., Ltd., and A. T. C. Priddle. July 6th, 1934. (440892.)

19947. "Cathode ray tubes." Radio Akt.-Ges. D. S. Loewe. July 8th, 1933. (440810.)

19968. "Electric couplings." G. H. Collins and H. F. Collins. July 7th, 1934. (440812.)

19969. "Electrically heated cooking utensils." G. H. and H. F. Collins. July 7th, 1934. (440813.)

20120. "Measuring apparatus for determining the humid contents of granular substances by measurement of the dielectric constant of same." S. H. Hartmann. July 9th, 1934. (440956.)

20288. "Electrical signalling systems." Automatic Electric Co., Ltd., and P. N. Roseby. July 10th, 1934. (441020.)

22010. "Control systems for electric hoists." British Thomson-Houston Co., Ltd. July 28th, 1933. (440898.)

22332. "Electric fans." General Electric Co., Ltd., and W. M. Cranston. July 31st, 1934. (440824.)

23752. "Protective arrangements for alternating current electrical circuits." General Electric Co., Ltd., W. Wilson and J. S. Cliff. August 17th, 1934. (440902.)

24884. "Automatic telephones and like selective systems." Siemens Bros. & Co., Ltd., and R. G. Dixon. August 29th, 1934. (440975.)

24930. "Ignition means for electric arc or discharge apparatus." English Electric Co., Ltd. August 30th, 1933. (440829.)

25977. "Electric relays." English Electric Co., Ltd., and E. W. Connor. September 10th, 1934. (440831.)

28951. "Electric contact-making relays." H. Greenly. October 10th, 1934. (440907.)

28977. "Wiring of electrical fittings." B.M.A.C., Ltd., and F. L. Campion. October 10th, 1934. (440908.)

29700. "Electric lamp-holders." W. F. Brown and Ranton & Co., Ltd. October 17th, 1934. (440836.)

30485. "Electric fires." E. Ellwood. October 24th, 1934. (440839.)

30544. "Electric torch." C. Fuksan, Gibb, Livingstone & Co., Ltd., and G. Wills & Sons, Ltd. October 24th, 1934. (441097.)

31132. "Thermostatically controlled electric switches." N. F. T. Saunders. October 30th, 1934. (441100.)

31859. "Electric-discharge lamps." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Gluhlampen). November 6th, 1934. (440911.)

31907. "Method of and means for deriving direct from alternating currents." A. J. Brown, and Baird Television, Ltd. November 6th, 1934. (440912.)

33865. "Flameproof containers for electric controllers." E.M.B. Co., Ltd., and S. Smith. November 24th, 1934. (440846.)

34405. "Electrical safety systems for railway crossings." C. Lorenz Akt.-Ges. December 1st, 1933. (Cognate application 34406/34.) (440847.)

36244. "Electric condensers." Dubilier Condenser Co. (1925), Ltd. June 6th, 1934. (Addition to 398929.) (440851.)

36429. "Television and like systems." J. L. Baird, and Baird Television, Ltd. December 19th, 1934. (440917.)

1935

104. "Wireless receiver circuit having a back coupled detector amplifier." January 1st, 1935. W. Neumann. (440856.)

759. "Combined apparatus for receiving wireless transmissions, transmitting and receiving line telephony, and making and reproducing sound records." Laboratoires de Radiotechnie Soc. Anon. January 9th, 1934. (Cognate application 762/35.) (440981.)

8146. "Method and device for the mechanical recording of sound or other oscillations." Phillips-Miller Naamlooze Vennootschap. March 22nd, 1934. (440861.)

13255. "Detachable terminal plates for electrical apparatus." Westinghouse Brake & Signal Co., Ltd. January 2nd, 1935. (440988.)

14974. "Illuminated signs." Claude-General Neon Lights, Ltd., and E. G. Pernet. February 11th, 1935. (Divided out of 27559/33.) (440933.)

15211. "Modulating systems for carrier-wave signalling systems." Standard Telephones & Cables, Ltd. June 9th, 1934. (440993.)

20945. "Electric pick-up for phonographs." Fabrica Italiana Magneti Marelli. August 10th, 1934. (440998.)

22271. "Method for the production of electrolytic deposits of rhodium." W. C. Heraeus, Ges. April 3rd, 1935. (440978.)

22630. "Storage battery plates." Chloride Electrical Storage Co., Ltd. (E. W. Smith.) August 10th, 1935. (440939.)

22697. "Vapour electric-discharge devices." British Thomson-Houston Co., Ltd. August 11th, 1934. (440999.)

23187. "Vapour electric-discharge devices." British Thomson-Houston Co., Ltd. August 18th, 1934. (441000.)

26113. "Positive column electric-discharge devices." British Thomson-Houston Co., Ltd. September 20th, 1934. (440945.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 29th :—

Town Crier (design only). No. 565055. Class 6. Machinery of all kinds.—Lissen, Ltd., Angel Road, Edmonton, N.18.

Cantra. No. 565461. Class 6. Electric fans.—Marelli & Co., Ltd., Artillery House, Artillery Row, Westminster, S.W.1.

Pyrotenax. No. 562804. Class 8. Electric cables and flexibles.—La Société Alsacienne de Constructions Mécaniques, Mulhouse, France (British representatives : W. P. Thompson & Co., 12, Church Street, Liverpool).

H (letter and design). No. 555419. Class 13. Electrical switches and plates therefor, electrical sockets and plugs, all being metal goods.—"Diamond H" Switches, Ltd., Gunnersbury Avenue, Chiswick, W.4.

Neorupt. No. 565310. Class 13. Electrical fusible cutouts.—Horstmann Gear Co., Ltd., 93, Newbridge Road, Newbridge, Bath.

Puritan (lettering and design). No. 565039. Class 50. Refrigerating cabinets.—Marco Refrigerators, Ltd., Manor Works, Rowan Road, Streatham Vale, S.W.16.

Corta. No. 565040. Class 50. Appliances made of synthetic resin for taking up slack in electric wires.—Jokubas Liusternikas, First Avenue House, 45, High Holborn, W.C.1.

Moroid. No. 565385. Class 50. Casein sold in the form of rods, tubes and sheets.—Morgan Ebonite Co., Ltd., Ashton Road West, Failsworth, Manchester.

Screened and Protected Cables

IN "Modern Trailing Cables," just issued by the General Electric Co., Ltd., a full description is given of the constructional features of the latest designs and types of Pirelli-General trailing cables, together with an account of manufacturing research and tests employed and some notes on the standard methods of repairing cable insulation and conductors. The booklet is well illustrated. Trailing cables with "Rhino" super-tough sheathing are available in a wide range of non-protected, partially protected, and fully protected types, many of which are described. The tendency of the Mines Department is to favour the use of cables in which a complete metal screen is interposed between the exterior and the power cores, the latter being collectively enclosed and the screen (or the outer screen of double screening), being connected to earth. In addition to the standard types in one special design the mains are split, providing individual cores of smaller diameter and allowing a full-sized pilot in the centre without increasing the overall diameter above that of a normal cable. In another type two screens normally formed of strands of fine tinned copper wire are arranged concentrically, the outer screening being earthed and the inner screen connected to a convenient source of low-voltage current; the two screens are interconnected by a relay or trip mechanism controlling a switch in the circuit containing the principal conductors. As the cable is completely covered by the screens it cannot be penetrated, even by a fine wire, without causing the protective system to operate.

For use where constant twisting and flexing causes chafing there is a patented form of screening of the copper-cum-whipcord type in which the metallic element consists of an inner and outer series of copper strands (on different pitch circles) applied on the cable in the same direction of inclination as that in which the cores are stranded. An intermediate series of cords is wound in a direction opposite to that of the wire strands. The groups of wire strands are arranged to overlap so that no object can pierce the cable without making contact with the screen, and, as rubber sheathing completely fills in the spaces between the elements of the screening, the two groups, though not immovably locked in position, are prevented from sliding over and under each other.

The concluding section of the booklet on standard repair methods draws special attention to a repair unit in the form of a small section of screening ready for installation on a cable. It comprises many multi-wire strands of tinned copper wire laid parallel and in contact with each other, the whole assembly being encased between two thin rubber sheets.